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THE KINSHIP OF MEN AND APES, ETC.

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ONLY the briefest reference can here be made to a few of the numerous contributions on the subject of man's relation to the animals below him. The rapidly-accumulating proofs of the close relation existing between man and the quadrumana, make interesting every fact, however trivial, in regard to the structure and habits of the higher apes.

Dr. Arthur E. Brown† has made some interesting experiments with the monkeys at the Zoological Gardens in Philadelphia. He found that the monkeys showed great fear, as well as curiosity, when a snake was placed in their cage, though they were not affected by other animals, such as an alligator and turtle. On the other hand, mammals belonging to other orders showed no fear or curiosity at a snake. These experiments, repeated in various ways, lead him only to one logical conclusion, "that the fear of the serpent became instinctive in some far-distant progenitor of man, by reason of his long exposure to danger and death in a horrible form, from the bite, and that it has been handed down through the diverging lines of descent which find their expression to-day in Homo and Pithecus" [*i.e.* Man and Ape].

The same author,‡ in an exceedingly interesting description of the higher apes, says: "Mr. A. R. Wallace once called attention to the similarity in colour existing between the orang and chimpanzee and the human natives of their respective countries. It would, indeed, seem as if but half the truth had been told, and that the comparison might be carried also into the region of mind: the quick, vivacious chimpanzee partaking of the mercurial disposition of negro races, while the apathetic, slow orang would pass for a disciple of the sullen fatalism of the Malay." [The resemblance between the gorilla and the negro is even more striking in some respects than that between the latter and the chimpanzee. I dwelt on this in an article on "The Gorilla and other Apes," in my "Pleasant Ways in Science," pp. 302, 303.—R. P.]

Dr. Brown§ has also given a description of the grief manifested by a chimpanzee on the death of its mate. His grief was shown by tearing his hair or snatching at the short hair on his head. The yell of rage was followed by a cry the keeper had never heard before, a sound which might be represented by *hah-ah-ah-ah-ah* uttered somewhat under the breath, and with a plaintive sound like a moan.

Mr. W. F. Hornaday* read at the Saratoga meeting of this Association an exceedingly interesting paper on the "Habits of the Orang," as observed by him in his native forests. He says, "Each individual of the Borneo orangs differs from his fellows, and has as many facial peculiarities belonging to himself alone, as can be found in the individuals of any unmixed race of human beings." After recounting the many traits of the orang, heretofore regarded as peculiar to man, he says: "Let any one, who is prejudiced against Darwinian views, go to the forests of Borneo. Let him there watch from day to day this strangely human form in all its various phases of existence. Let him see it climb, walk, build its nest, eat and drink and fight like human 'roughs.' Let him see the female suckle her young and carry it astride her hip precisely as do the coolie women of Hindoostan. Let him witness their human-like emotions of affection, satisfaction, pain, and childish rage—let him see all this, and then he may feel how much more potent has been the lesson than all he has read in pages of abstract ratiocination.

Professor W. S. Barnard several years ago, in a study of the myology [or muscle-work] of man and apes, showed that the scansorius muscle which Trail studied in the higher apes and which he supposed had no homologue in man, was really homologous with the *gluteus minimus* in man. Dr. Henry C. Chapman,† in a study of the structure of the orang-outang, has confirmed the truth of Barnard's discovery. Dr. Chapman is led to infer that the ancestral form of man was intermediate in character, as compared with living anthropoids or lower monkeys, agreeing with them in some respects and differing from them in others. [This view is discussed in an article on "Our Ape Cousins," in a recent volume of Knowledge.—R. P.]

The osteological affinities which man has with the *Lemuridæ*, as insisted upon by Mivart, are also recognised by Cope.‡ In a general paper on the "Origin of Man and other Vertebrates," he says: "An especial point of interest in the phylogeny [or tribe origin—but oh! these wordmongers!] of man has been brought to light in our North American beds. There are some things in the structure of man and his nearest relatives, the chimpanzee, orang, &c., that leads us to suspect that they had rather come from some extinct type of lemurs."

It would seem as if we must look farther back than the higher apes for the converging lines of a man's relations with them. The earliest remains of man or the apes found fossil, presenting as they do marked types with little tendency to approach one another, would in themselves suggest an earlier origin for both stocks. [And that earlier origin must share descent with contemporary races from an earlier origin still; and that, &c.—R. P.]

In a paper by Professor Cope§ on "Lemurine Reversion in Human Dentition," he says, in concluding his article: "It may be stated that the tritubercular superior molars of man constitute a reversion to the dentition of the *Lemuridæ* of the Eocene period of the family *Anaptomorphidæ*, and second, that this reversion is principally seen among Esquimaux and the Slavic, French, and American branches of the European race."

In another paper by the same author‖ on the "Developmental Significance of Human Physiognomy," he compares the proportions of the body and the facial peculiarities of man with the higher apes and human infants, and shows that

* From an article on American Zoologists and Evolution, in the "Popular Science Monthly." (New York.)
† "American Naturalist," vol. xii., p. 225.
‡ Ibid., vol. xvii., p. 119.
§ Ibid., vol. xiii., p. 173.

* "American Naturalist," vol. xiii., p. 712.
† "Proceedings of the Philadelphia Academy of Natural Sciences," 1880, p. 163.
‡ "Popular Science Monthly," vol. xxvii., p. 609.
§ "American Naturalist," vol. xx., p. 941.
‖ Ibid., vol. xvii., p. 618.

XUM

the Indo-European, on the whole, stands higher than the other races in the acceleration of those parts by which the body is maintained in an erect position, and in the want of prominence of the jaws and cheek-bones, which are associated with a greater predominance of the cerebral part of the skull and consequently greater intellectual power.

Dr. Harrison Allen,* in a study of the shape of the hind-limb as modified by the weight of the trunk, dwells on the manner of articulation in the gorilla of the fibula with both calcaneum and the astragalus, as well as the fact that the astragalus in that genus possessed a broad, deflected fibula facet, and says: "This pecular projection is rudimental in the astragalus of civilised man, but was found highly developed in an astragalus from an Indian grave found at Cooper's Point, New Jersey."

In my Buffalo address, I alluded to a paper by Professor N. S. Shaler on the intense selective action which must have taken place in the shape and character of the pelvis in man on his assumption of the erect posture—the caudal vertebræ turning inward, the lower portion of the pelvis drawing together to hold the viscera, which had before rested on the elastic abdominal walls, the attending difficulty of parturition, &c. Dr. S. V. Clevenger† has since called attention to other inconveniences resulting from man's escape from his quadrumanous ancestors. In a paper entitled "Disadvantages of the Upright Position," he dwells particularly on the valves in the veins to assist the return of blood to the heart, which, considered from the usual teleological point of view seems right enough; but why, he asks, should man have valves in the intercostal veins? He shows that in a recumbent position these valves are an actual detriment to the flow of blood: "An apparent anomaly exists in the absence of valves from parts where they are most needed, such as the venæ cavæ, spinal, iliac, hæmorrhoidal, and portal. The azygos veins have important valves. Place man upon 'all-fours,' and the law governing the presence and absence of valves is at once apparent, applicable, so far as I have been able to ascertain, to all quadrupedal and quadrumanous animals. Dorsad veins are valved; cephalad, ventrad, and caudad veins have no valves." By means of two simple diagrams he shows clearly the distribution of valved and unvalved veins as they exist in mammals, and why in man the same arrangement becomes detrimental. He dwells on the number of lives that are sacrificed every year by the absence of valves in the hæmorrhoidal veins. He also mentions other disadvantages in the upright attitude, as seen in the position of the femoral artery, even with man's ability to protect it. Its exposed condition is a dangerous element. Inguinal hernia, of rare occurrence in mammals, occurs very often in man, at least 20 per cent. being affected. Strangulated hernia also causes many deaths. Prolapsus uteri and other troubles and diseases are referred to by Dr. Clevenger as due to the upright position. In other words, the penalties of original sin are in fact the penalties resulting from man's assumption of the erect posture. [For an account of Dr. Clevenger's views, see article on "Upright Man" in my "Universe of Suns."—R. P.]

In another paper by the same author,‡ on the "Origin and Descent of the Human Brain," he gives an interesting sketch of the phylogenesis of the spinal cord to its ultimate culmination in the development of the brain of man. He says that the most general interest centres in the large mass of cells and nerve-fibres called the cerebrum. "In the ornithorhynchus it is smooth and simple in form, but the beaver also has an unconvoluted brain, which shows at once the folly of attaching psychological importance to the number and intricacy of folds in animal brains. With phrenology, which finds bibativeness in the mastoid process of the temporal bone, and amativeness in the occipital ridge, the convolutional controversies must die out, as has the so-called science of palmistry, which reads one's fate and fortune in the skin-folds of the hand."

Professor Alexander Graham Bell* has presented a memoir to the National Academy on the "Formation of a Deaf Variety of the Human Race," in which he shows by tables a series of generations of certain families in which the progenitors being deaf-mutes this peculiarity becomes perpetuated in many of the descendants. Recognising fully the laws of heredity, natural selection, &c., he shows that the establishment of deaf-mute schools, in which a visual language is taught which the pupils alone understand, tends to bring them into close association with one another; and that naturally, with this seclusion, acquaintance ripens into friendship and love, and that statistics show that there is now in process of being built up a deaf variety of man.

Dr. W. K. Brooks,† animated by the cogency of Professor Bell's reasoning, is led to prepare an article, entitled "Can Man be Modified by Selection?" In this paper he discusses the startling proposition of Professor Bell, and recognises the convincing proof which he furnishes to show that the law of selection does place within our reach a powerful influence for the improvement of our race. The striking character of the tables of facts presented by Professor Bell, and the significant suggestions of Dr. Brooks, lead one to consider how far the influence of selection has had to do with the character of great communities, as to their intelligence or ignorance. When we see nations of the same great race-stock, one showing a high percentage of illiterates, a high death-rate, degradation and ignorance, while just across the borders another nation, apparently no better off so far as physical environments are concerned, with percentage of illiterates and death-rate low, intelligent and cleanly, we are led to inquire if here a strict scientific scrutiny with careful historical investigation will not reveal the cause of these conditions. Can it be proved beyond question that the illiteracy and degradation of Italy and Spain, up to within recent years at least, is the result of centuries of church oppression and the Inquisition, destroying at once or driving out of the land all independent thinkers, and at the same time forcing her priests to lead celibate lives and inducing others of cultivated and gentle minds to lead cloister lives? Is it also a fact, as Alphonse de Candolle asserts, that by far the greater number of distinguished scientists have come from Protestant pastors? He gives a significant list of eminent men whose fathers were Protestant pastors, saying that, had they been priests of another religion, leading celibate lives, these men would not have been born.

It is considered an intrusion into matters which do not concern science when such inquiries are made, but the scientist has very deeply at heart the intellectual and moral welfare of the community. If the cause of degradation and ignorance, of poverty, of contagious disease, or of any of the miseries which makes a nation wretched, can be pointed out by scientific methods, then it is the stern duty of Science to step in, and at least show the reasons, even if the remedy is not at once forthcoming. The men who would be reformers and agitators, and who by their earnestness and devotion get the attention of multitudes, are unfit for their work if they show their ignorance, as most of them do, of the doctrines of natural selection and derivation.

* "Proceedings of the Philadelphia Academy of Natural Sciences," 1885, p. 383.
† "American Naturalist," vol. xviii., p. 1.
‡ "American Naturalist," vol. xv., p. 513.

* "Memoirs of the National Academy of Science," vol. ii., fourth memoir.
† "Popular Science Monthly," vol. xxvii, p. 15.

WEIGHING THE EARTH.

THE great difficulty in determining the earth's mass arises from the circumstance that it surpasses so enormously that of any known body with which we can compare it. A mountain may exert an attraction measurably comparable with that of the earth; but a mountain is not a known mass, for we are not able to examine the mountain's whole structure, and short of such examination the mountain's mass must remain doubtful. We may descend into mines and recognise a change in the force of gravity suggestive of the law or laws according to which the density of the earth's interior varies as the centre is approached; but we must always remain in doubt how far the change may be due to peculiarities in the structure of the strata through which the mine penetrates. The only trustworthy determinations of the earth's mass are those in which the attraction of some known mass of matter, as a globe of lead or platinum, is directly compared with that of the earth; and the largest masses of the kind which have yet been used in this way have been so infinitesimally small compared with the mass of the earth, that it is only by apparatus of extreme delicacy that any measurable alteration of terrestrial attraction has been produced; so that all experiments of the sort are affected by a certain degree of uncertainty, depending on the delicacy of the methods employed, and what may be called the tenuity of the results deduced.

FIG. 1.—The Schehallien Experiment for determining the Earth's Mass.

It is a serious mistake to describe the measurements of the earth's mass made by Maskelyne on Mount Schehallien, and by Mr. Dunkin in the Hartley coal-mine, in terms implying that the precision of the processes employed involved a corresponding degree of accuracy in the results obtained. Nothing but the most precise and careful observation and experiment could have led to any observable, still less to any measurable results. But we must not suppose, because exceedingly delicate and precise observation can alone lead to any results at all in such experiments, that therefore results obtained by such observation are themselves of corresponding precision; on the contrary, the reverse must be assumed, unless the results obtained by different researches of this class shall be found to agree so closely as to indicate more trustworthiness in such methods than had been anticipated. But this has not happened. On the contrary, the reverse has thus far proved to be the case.

The Schehallien experiment, and experiments of the same type, may, with amply adequate precision, be thus described:—

Let M m, M′ m', fig. 1, be the slopes of a mountain such as Schehallien, suitably situate so that whatever attraction its mass may be capable of exerting can be estimated with fair chance of freedom from serious error; in other words, the mountain must stand in some degree apart, must admit of being thoroughly surveyed by geologists, and must present such features as suggest probable uniformity of interior stratification. Suppose now that B and B′ are two stations on a meridian—that is, on the same north-and-south line—whose positions have been determined by trigonometrical survey. Observations made at B and B′ with the zenith sector would indicate the true difference of latitude between B and B′, were the plumb-lines at B and B′ in the true vertical directions A B and A B′. But if the attraction of the mountain's mass draws these plumb-lines into the positions A b and A′ b', then the latitudes of B and B′ as determined by the zenith sector would be incorrect. Evidently, B being the northern station, and B P′ the direction of the polar axis, the plumb-line A b makes a smaller angle than A B, the true vertical, with the direction of the pole, or seems to indicate for B too high a latitude; while A′b' makes a larger angle than A′B′ with the polar axis, and seems to indicate for B′ too low a latitude. Both displacements increase the apparent difference of latitude; and comparing the difference of latitude determined by trigonometrical survey with the difference indicated by the plumb-lines at B and B′, the disturbing effect of the attraction of the mountain-mass is determined. Hence, after reductions and computations which, though seemingly complex, depend on established and even simple principles, the astronomer is able to compare the attraction of the earth with the attraction of the mountain, and if the mass of the mountain can be ascertained, the mass of the earth can be deduced.

Bouguer and La Condamine, during experiments on Chimborazo, recognised the effect of the mountain's attraction in deflecting the plumb-line (by about 11″), but no estimate of the earth's mass was obtained, the conditions being too complex and uncertain. It was not till 1774 that a definite attempt was made to measure the earth's mass by this method. In that year Maskelyne made observations on the northern and southern slopes of Schehallien, a mountain only 3,000 feet in altitude, but well suited for the experiment. The sum of the deflections observed amounted to 11″·6; and from this result Messrs. Hutton & Playfair, after as thorough an examination of the mountain's structure as could be made, deduced for the earth's mass a value corresponding to a mean density exceeding that of water 4·713 times. Observations made in 1885 on Arthur's Seat by Colonel James, Superintendent of the Ordnance Survey, indicated a mean density of 5·316.

Another method depends on the diminution of attraction as we ascend above the earth's surface. The rate of oscillation of a pendulum will be calculably reduced at a height of two or three miles above the sea-level. If set at such a height on a mountain summit, the attraction of the mountain's mass will diminish the reduction of the rate of oscillation. Hence, if we know the mass of the mountain and measure the effect of its attraction, we can deduce the mass

of the earth.* From observations made on Mont Cenis by this plan, Plana and Carlini deduced a value of 4·950 for the earth's mean density.

The converse of this method has also been used. If the oscillations of a pendulum at the sea-level be compared with those of a pendulum at a great depth below that level (as in a deep mine), we can compare the mass of the whole earth with that of an outer shell limited by an imaginary spheroidal surface concentric with the surface of the earth, and passing through the underground station. For this shell, supposing it homogeneous, would exert no attraction at all at the lower station, and its non-homogeneity can be taken into account. The pendulum at the lower station is attracted only by the mass within the imagined spheroidal surface, with such corrections as may be due to the irregularities of the structure of the shell exterior to it, and more particularly to peculiarities in the neighbourhood of the mine where the experiment is tried. If the earth were of uniform density the attraction at the lower station would obviously be less than that at the outer, in the same degree that its distance from the centre is less; for masses of the complete sphere and of the sphere within the lower station are proportioned as the cubes of their radii, while gravity at the two stations would be as these masses directly and inversely as the squares of those radii; hence, considering both the masses and the distance, the attractions at the two stations would be inversely as the distances of these stations from the earth's centre. But if the earth's density increases towards the centre, the attraction at the lower station may be equal to or greater than that at the upper. Apart, then, from considerations depending on the configuration of the mine and the structure of the strata through which it has been dug,* the interpretation of the observed difference of

* The time of oscillation of a pendulum of given length, l, is inversely proportional to $\sqrt{g}$, where g represents the force of gravity as measured by the velocity it can generate in a unit of time. Hence, if g, g' represent gravity at the sea-level and at height h above that level respectively, and t, t' are the respective periods of oscillation as calculated for stations so situated respectively (the attraction of the mountain itself being neglected), we should have, approximately,;

$$t : t' :: \sqrt{g'} : \sqrt{g}$$
$$:: r : r+h$$

(r being the earth's radius). For, regarding the earth as a globe made up of concentric layers, each of uniform density, the earth's whole mass may be supposed at the centre, and gravity therefore inversely as the squares of the distances from the centre—that is, $g : g' :: (r+h)^2 : r^2$.

But if calculations based on the known configuration and structure of the mountain indicate that its mass would produce an attraction f on a body at its summit, and t'' be the observed time of oscillation at the mountain's summit,

$$t : t'' :: \sqrt{g'+f} : \sqrt{g}.$$

Thus, if the times of oscillation t and t'' be accurately compared, while t' is computed, we obtain the ratio of t' to t'', or $\sqrt{g'+f}$ to $\sqrt{g'}$; whence the ratio of f to g' and thence to g is obtained; and thus the mass of the earth may be compared directly with that of the mountain. Of course, though the principle of the method is thus indicated, the actual computations are by no means so simple.

* The effect of the removal of large quantities of material from below the surface is to *increase* the attraction on the pendulum at the bottom of the mine. It will suffice, in illustration of this, to consider the earth regarded as a homogeneous globe, and the space dug out as of some regular figure, as a cylinder. The student will readily infer (which is all I wish here to indicate) the nature of the general considerations which have to be taken into account in dealing with such problems:—

Let B, fig. 2, be a mine of any figure, with, however, a horizontal base. Take the spherical shell A S C, of which the inner surface coincides with the base of the mine. Then the attraction at the bottom of the mine is that due to the mass of the sphere within the shell, plus the attraction of the incomplete shell; and the incomplete shell attracts the particle towards the earth's centre with a force precisely equal to the repulsion due to a mass filling the space B. For if the attraction exerted by the incomplete shell be A, and that exerted by the portion B (supposed filled) be B, then we know that

$$A + B = 0$$

or

$$A = - B.$$

Hence, instead of considering the incomplete shell A, we need only consider the *repulsion* exerted by a mass filling B, every particle of which is to be supposed to repel with a force exactly equal to that with which it would in reality attract.

Fig. 2.—Illustrating the Mine Method of Weighing the Earth.

Fig. 3.—Illustrating the Determination of Gravity at the Bottom of a Mine.

Let us suppose our mine to be cylindrical, fig. 3, representing a section through the axis and the shaft S coincident with the prolongation of the axis. A pendulum is swinging at Q and another at P in Q S produced. The shaft is supposed so narrow that we need not consider it, and, for convenience, we suppose its length equal to half the depth of the mine:—

Let r = earth's radius
$2a$ = mine's depth (Q P)
a = length of shaft (Q S)
b = radius of cylinder (B P)

Then the attraction at Q is equivalent to the attraction of a sphere of radius r, diminished by the attraction of the cylinder A D, that is (from the known value of the last-named attraction—

$$= \frac{4\pi\rho r}{3} - 2\pi\rho\left\{a - \sqrt{4a^2+b^2} + \sqrt{a^2+b^2}\right\}, \quad (\alpha)$$

(ρ being the density of the supposed homogeneous sphere).

Again, the attraction at P is equivalent to the attraction of a sphere of radius $r - 2a$, increased by the *repulsion* of the cylinder A D, that is—

$$= \frac{4\pi\rho(r-2a)}{3} + 2\pi\rho\left\{a - \sqrt{a^2+b^2} + b\right\}, \quad (\beta)$$

The excess of the attraction at Q over that at P—that is, the difference of the expressions (α) and (β)—is

$$\frac{8\pi\rho a}{3} + 2\pi\rho\left\{\sqrt{4a^2+b^2} - 2a - b\right\}$$

$$= 2\pi\rho\left\{\sqrt{4a^2+b^2} - b\right\} - \frac{4\pi\rho a}{3}; \quad (\gamma)$$

and, according as this expression is positive, zero, or negative, the

attraction at the top and bottom of the mine is a matter of sufficient simplicity.

Though it is tolerably obvious that this method of determining the earth's attraction must be even less trustworthy than experiments of the Schehallien type, the method commended itself to the mind of Sir George (then Professor) Airy, and after two failures in the Dolcoath mines, he had the method tried in the Harton Colliery, near South Shields, where a depth of 1,260 feet was available. It is not necessary to describe the contrivances by which two pendulums were compared, one swinging at the top the other at the bottom of the mine, the pendulums being interchanged after intervals of 104 hours and 60 hours—that is, each working 104 hours above and below, and then each working 60 hours above and below. The work was conducted with great care and skill by Mr. Dunkin, of the Greenwich Observatory, to whom, however, no portion of the credit has hitherto been given in treatises on astronomy.

The observations showed that at the foot of the mine either pendulum gained two seconds and a quarter per day, showing that gravity was increased by $\frac{1}{1\,9\,1\,9\,0}$ part. This result cannot be sensibly in error, so carefully were Mr. Dunkin's operations conducted. But the inferred increase of density towards the earth's centre—that is, the deduced mean density of the earth—can by no means be regarded as ascertained with corresponding accuracy. We do not make an ordinary foot-rule more precise for measuring purposes by careful and complicated experiments on the changes it undergoes under the varying influences of temperature, moisture, and so forth—it remains a foot-rule still, with all a foot-rule's shortcomings as a measurer. The complicated calculations and corrections effected by Mr. Dunkin did not even touch the real defects of the mine method of weighing the earth; it remained rough and untrustworthy. A comparison of the final result with that obtained by experiments of the Schehallien class—which, though certainly not trustworthy, were at least as trustworthy as the mine experiments—suffices to show how little either method can be trusted. The earth's mean density, as calculated by Mr. Airy from the Harton experiments, was 6·565 times that of water, and the results of the mountain and mine methods combined appear as follows:—

	Mean Density (Water's = 1).
Maskelyne's Schehallien experiment (corrected by Playfair)	4·713
Carlini's pendulum experiments on Mont Cenis (corrected by Giulio)	4·950
Colonel H. James, from attraction of Arthur's Seat	5·316
Dunkin and Airy, from experiments in Harton Colliery	6·565
Mean	5·386

The mean value is probably, as we shall see, near the truth; but as the greatest value differs from the least by 1·852, or more than a third of the mean, the results—except Colonel James's—are discredited by the very circumstance that the mean value is nearly right; and all three *methods* are discredited, the correctness of Colonel James's result being thus shown to be merely accidental. If the length of a piece of ground had to be measured, and one workman said that measuring it in a certain way he found it to be 471 feet long, while another using a different method made it 495 feet long, and a third, using yet another method, found it to be 657 feet long, their employer would not regard their work or their methods as satisfactory if he presently found that a thoroughly trustworthy measurement showed the piece of ground to be 550 feet long, even though that is not far from the mean of the results obtained by three unsatisfactory methods. And if, later, a fourth workman, employing one of those methods, deduced as a result 539 feet, trust in that method would not be greatly increased. It would be felt that either the approach of the result to the truth was accidental or it was more or less consciously forced.

Airy expressed the opinion that the result of the Harton Colliery experiment was comparable on at least equal terms with those obtained by other methods, though it differs by 20 per cent. from the mean of the results obtained by all methods, and the results presently to be considered do not differ by more than 2 per cent. from their mean value, nor by 4 per cent. from the general mean. I prefer the opinion of Sir Edmund Beckett (now Lord Grimthorpe), that the result of the Harton Colliery experiments "cannot be accepted," and is "not to be compared in value" with those obtained by the Cavendish experiment.

The ingenious Michell, to whom science owes the first satisfactory reasoning about the architecture of the sidereal heavens, devised the method of weighing the earth which is commonly named after the eminent chemist Cavendish, who first successfully applied it.

(*To be concluded.*)

attraction at Q is greater than, equal to, or less than the attraction at P. Putting (γ) equal to zero, we get

$$3\sqrt{4a^2 + b^2} = 3b + 2a$$

or

$$36a^2 + 9b^2 = 9b^2 + 12ab + 4a^2$$

that is

$$32a = 12b.$$

Hence, if b, the radius of the cylindrical mine, is equal to four-thirds its total depth, the attraction at P will be equal to that at Q. If the mine be wider, the attraction will be greater at P than at Q.

All other cases may be similarly treated, though, of course, the problem will not in all cases be so simple as the above.

COAL.

By W. Mattieu Williams.

MINERS' LAMPS AND COLLIERY EXPLOSIONS.

APPILY for themselves, few or none of my readers have any practical acquaintance with absolute darkness. With the exception of a skilfully devised horror—the dark punishment cell in some of our prisons—scarcely any place can be found above ground where such darkness prevails. But in a coal-pit, without lamp, it exists in perfection. The lighting of a coal-mine is a serious problem, not because illuminating gas is dear, but for the opposite reason. Lead, copper, and other mines in which metals and their ores are worked, are lighted by the primitive device of wearing a candle in the front of one's hat while travelling down the shaft or along the workings, and sticking it in a miner's candlestick, a lump of clay, which is superior to ordinary candlesticks, inasmuch as it may rest on the ground or constitute its own bracket by being dabbed against a wall, or take any other position required.

Primitive oil-lamps of pattern closely resembling those found so abundantly in Pompeii, or metal lamps with a hook at one side for attachment to the hat or hanging to ledges, are used, and others with a spike below for similar purpose; but the candle and lump of clay is the general favourite. Paraffin lamps have been lately introduced.

Candles and such lamps may be used in some coal-mines, but these are exceptional, the majority of coal-mines being "fiery." This means that hydrocarbon gas, which has been

occluded or imprisoned for ages, starts forth on breaking down the coal, and may accumulate to a dangerous amount. So far as I have been able to learn, no coal-mine is free from "fire-damp;" in those that are worked with naked lights, "blowers" of gas may occasionally be heard, and seen when the men apply their candles to them, producing great jets of flame by their ignition.

Mr. Galloway has now satisfactorily proved that hydrocarbon gas is by no means the only source of dangerous explosions. Coal-dust mixed with air forms an explosive of terrible potency, and in most of the great colliery explosions it has been a serious factor, in some cases probably by far the most serious. A small explosion of gas, which alone would do no mischief, may operate by blowing up and firing the dust in its immediate neighbourhood; and this secondary explosion may do the like further on, and thus the blown-up dust may act like a train of gunpowder with the most terrible results. The drier the pit and workings, the greater is this danger, and as we descend to deeper and deeper seams, dry workings become more and more common, and thus the coal-mines of the future will become progressively more and more dangerous.

We read in pretty books about the miner's glow-worm lamp, and a pretty picture is thrown upon the magic-lantern screen of the lecturer, displaying a collier at work with a bottle full of these pretty creatures hanging by his side to cheer and guide him in his work. I doubt whether such a pretty lamp ever existed outside of these pretty books and pretty pictures. It may have been tried, but, having kept a few pet glow-worms for a couple of years in a fern case, and watched their habits, I conclude that they would object to being bottled in crowds, and would not waste their illuminating energies when thus imprisoned, especially as they light up for the purpose of courtship only during a short courtship season.

The "steel mill" was really used. It was a wheel with steel periphery, which, when rapidly rotated with a flint pressed against it, threw out a shower of sparks. These gave sufficient light, but they were also capable of firing the gas. I have illustrated that to a class by thrusting a brightly-heated iron wire through a bladder containing a mixture of hydrogen and oxygen gases, which thus treated explodes instantly. The sparks of the steel mill are simply incandescent particles of steel.

The introduction of the wire-gauze lamp altered all this. Serious explosions that occurred in Durham in 1812 led to the formation of a Society for the Prevention of Accidents in Coal-mines. It was at a meeting of this society in Sunderland in 1813 that Dr. Clanny, of Newcastle, exhibited his first lamp. He had worked upon the problems for some time. George Stephenson, then a humble engine-wright at the Killingworth Colliery, Newcastle, was doing the same, and practically introduced a wire-gauze lamp in 1815. His first lamp was ready on October 21, further improved on November 4, and fairly and practically in use November 30 at Killingworth under the name of the "Geordie Lamp." I will not enter upon the controversy respecting the personal merits of the different inventors beyond expressing my opinion that the merit of Davy was rather that of demonstrating the *rationale* of the action of the wire gauze in resisting the passage of flame between its meshes than of the invention of the lamp. There can be no doubt that too much has been claimed for Davy. Smiles, in his Life of George Stephenson, concludes that the illustrious chemist and the humble engine-wright arrived by wholly independent paths at a knowledge of the facts concerning the non-passage of flame through tubes and small apertures.

The principle upon which the efficacy of the Geordie or Davy lamp depends may be easily demonstrated by lowering a piece of wire gauze upon a common gas flame. As the gauze descends it will be seen that the flame does not pass between its meshes, but is effectually extinguished when it touches the metal. On applying a light to the upper surface of the gauze another upper flame appears, which is evidently a continuation of the partially-extinguished flame below. The gas passes between the meshes, but the flame cannot. Neither can a flame travel through cold metal tubes of small bore; but if either the gauze or the tube be made red-hot, it no longer stops the flame. A further demonstration is afforded by making a candle with a small thread wick, and when the wick is lighted passing over it a metal ring with an opening equal to the whole width of the flame. Although presenting no mechanical obstruction, the flame is completely extinguished by the cold ring.

The reason is very simple. The flame is due to the energetic combination of the hydrocarbon gas with oxygen, but this combination does not occur unless the gases be heated to a certain point. This heat, which is necessary for the continuance of the combustion, is carried away by the metal, which is a good conductor. The potency of metal in carrying away the heat of a flame is well shown by stretching a pocket-handkerchief, or piece of rag, over the convex side of the bowl of a silver spoon, and plunging the fabric into a gas-flame. It may be held there for some time without being even scorched, but if the experiment be repeated on a wooden spoon a hole is rapidly burned in it. The flame of a jet that is issuing with some force—as from a blow-pipe or Bunsen burner—may pass through the gauze according to velocity of issuing gas and size of mesh. Also, if the gauze is red-hot, its power of obstructing the flame is lost.

These facts indicate a limitation to the practical efficiency of the miner's lamp. When surrounded with gas outside, the space within the gauze is filled with flame, and this warns the miner of his danger. But the warning may itself be fatal if he becomes alarmed, and rushes forward too rapidly, or sways his lamp carelessly, and thus produces a through current that shall blow the inner flame outward. It is rarely that a human being is placed in a position demanding more of true courage than that of the miner when the flame of his lamp wick first elongates, then is surmounted by a blue cap, and finally flashes into a lambent flame that fills the lamp. He must hasten to the shaft for his life's sake, for if he is too tardy the gauze will become red-hot. If he rushes forward, or otherwise moves his lamp with a speed exceeding 4 or 5 feet per second, he will probably kill himself and all his comrades. In the midst of this dilemma he knows that others are in the same position, and that lack of courage and coolness of any one may be destructive to all.

A number of devices have been adopted to diminish this danger, far too many for me to describe or even name here. Double gauze, glass protection outside the gauze, as in the "Geordie," are among these, and are more or less effective, but none are perfect. My surprise is not that so many colliery explosions occur, but that they are so few. The flippant comments on the ignorance of the miners that are so commonly made are really due to the ignorance of the commentators. The old story of the man who was descending a dangerous pit with a lighted candle on his hat, and, when reprimanded, replied, "Well, arnt I got my Davy?" may amuse a magic-lantern audience, but those who know the simple but shrewd-minded colliers are amused in contemplating the self-sufficient silliness of the audience, who can suppose that their fellow-men, who are daily carrying their lives in their hands, are ignorant of the primary conditions upon which their safety depends.

It is true that familiarity with any danger induces a

certain degree of recklessness, and possibly some disasters may have arisen from foolhardy fellows uncovering their lamps to light their pipes; but every collier can gauge the amount of explosive gases surrounding him by the state of his lamp flame, and there is such a thing as public opinion underground. Any man known to be guilty of risking the lives of all his fellow-workers for the sake of a smoke would not escape unpunished by those upon whom the outrage had been committed, especially by the women above ground with vested interests in husbands below.

Considerable progress has recently been made in the electric lighting of mines. Portable batteries and accumulators are used as sources of power. Their weight, as at present constructed, is a great objection. This will probably be diminished with further progress. But even this will demand protection, as the breaking of the glass bulb of an incandescent lamp would expose a filament of burning carbon nearly as dangerous as a flame. Perhaps their worst defect is the absence of the warning which is given by the behaviour of the common lamp flame.

LIFTING GREAT WEIGHTS.

IFTING exercises are open to the objection that they tend only to increase the strength of the body, activity not being increased by any of them. A man who follows lifting work only will be a slow mover, and what Blaikie calls "muscle-bound," meaning that the muscles themselves, by their undue or disproportionate development, limit the play of limb. Without agreeing with him that the full degree of lissomeness which can be attained by exercises of a contrary tendency is desirable, we must admit that a muscle-bound condition is disadvantageous. Yet lifting exercise, pursued with due consideration of the necessity for an adequate amount of correcting exercise, is exceedingly useful, because in our daily life we constantly find occasion for the use of the lifting powers of the body.

Lifting from the shoulder ought to be but a portion of the lift from the ground to the full height of the upstretched arm or arms. To lift a pair of weights from the ground, slowly raising them to and past the level of the shoulders, and thence to thrust them upwards, still slowly, till the arms straighten, is a much severer exercise than to raise the same weights from the shoulder only. And this last, again, is more trying than to send up the same pair of weights with sufficient velocity to carry them past the dead part of the lift, which ranges from the height of the mid-chest to a few inches above the shoulder. I, who can make no claim to exceptional strength, can readily (or could a year or two since, and suppose I still can) lift any one not exceeding 140 or 150 lbs. in weight to the full upward reach of my arms if I start right; but I could not lift two-thirds of that weight slowly from the ground to above my head, or even slowly from the height of my waist. The way to lift any one easily in that manner is to place one hand upon the waist, passing the other under the knees so that the body of the carried sinks somewhat, a motion resisted by the elasticity of the arms and legs of the carrier and converted into an upward motion from a height favourable to lifting—such rapidity of rise being communicated that the body is carried over the dead part of the lift, after which the arms readily straighten and carry the weight to the full height. The exercise is not to be recommended, however, as a safe one for the person lifted, because the person lifting has to shift the hold of both hands on the way up, and if this is not deftly done an unpleasant fall is apt to result. (The last time I attempted a feat of the kind I was standing before a tall wardrobe with my wife, when she remarked, joking, "I wish I could get into that top shelf"—into whose recesses she had been vainly reaching. I naturally pretended to take her in earnest, and in another second she was on the level of that shelf, but I fear not more favourably placed for getting what she wanted than when on the floor. In that case, however, there was no danger of a fall because of the wardrobe's position.)

Nathalie, a French female gymnast, was able, according to Farini, to take two 56 lb. weights from the ground, one in each hand, and put them slowly above her head. Let those who can easily put up two such weights with a quicker motion, try the slow movement, even with much smaller weights, and they will recognise the difference. Farini pointed out to Charles Reade that putting up an agile gymnast is mere child's play to this, "because, in dealing with the live object, the strong stoops, the agile springs, and the strong arms are at an angle of 45 before the weight tells; now," proceeds Reade, "the arms, as they near the perpendicular, can hold up three times the weight they can put up." (He should rather have said that the arms as they near the perpendicular can put up three times the weight they can lift up before they reach that position; they can, however, lift up from the ground twice the weight they can push up to their full upward reach.)

Lifting at arms' length exercises, so far as the arms are concerned, an entirely different set of muscles from those used in putting up weights. Nor can strength be so satisfactorily tested, or compared, by the former as by the latter exercise. A long-armed man is here at a disadvantage, and judging by the weight he can lift, might appear weaker than a short-armed man really of less power in the arms. I remember the disgust with which when at college I found men whom I knew to be no stronger than myself able to lift greater weights at arms' length, till I noticed that the unusual length of my arms, which span horizontally fully half a foot more than my height, put me at a disadvantage, owing to the extra leverage involved. Our strongest man at Cambridge University then (1856 to 1860 was my time) was, I believe, Mr. Duncan Darroch, who rowed "four" in the 'Varsity boat in 1858, the year when Cambridge rowed the famous race (which they won by 2 feet 6 inches) with the London Club eight, manned by Casamajor, Playford, the Paines, and other famous oarsmen of the days before sliding seats were invented. Mr. Howard Snow, afterwards one of the masters at Eton, and now—but with altered name—head master at Cheltenham College, and himself a famous oarsman, stroke of the Cambridge boat in 1857 (and bracketed first in classics in 1858), wrote of Darroch, in somewhat doggerel rhymes:—

> He'll lift as much as any other one can
> Will Duncan;
> He has the strength of an entire barrack,
> Has Darroch!

Darroch could lift a 56 lb. weight at arms' length. But Darroch was short-armed for his height, and, as I remember him, a muscle-bound man. Few men can expect by any amount of training and practice to acquire the power of lifting such a weight as 56 lbs. at arms' length. Thirty pounds would be a very fair arms'-length lift for men of average strength; and even that would require exercise and training.

Very good exercise in lifting can be obtained without special apparatus, as by lifting chairs in different ways. Thus the chair may be lifted at arms' length by a front rung grasped knuckles upwards or knuckles downwards; or by the lower end of a front leg—the back being in every case brought to a vertical position, and so maintained while

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the lift lasts. Strength may be tested either by the weight of the chair lifted, or by the time during which the chair is held out.

It is noteworthy that often the man who can lift the heaviest chair at arms' length in some particular way, may be surpassed by another when the mode of lifting is altered. And, again, those who lift the heaviest weights in these ways are not always those who can maintain their hold longest. Resolution comes in as a factor in the last-named test. One will often see a great and strong but easy-going man lift out at arms' length a weight which another cannot bring for a moment to that position, who yet will not hold out half that weight for half the time at which it will be held out by the weaker, whose resolute will enables him to sustain his hold to the very last.

In all these forms of lifting the arms are chiefly considered. Yet in reality the lower limbs have their work to do, not only in sustaining the extra weight, but in sustaining also the weight of the body. It is only in exercises which require the body to be lifted from the ground that the legs get no work. Such exercises are among the severest tests of strength, because they reverse the usual order of things. To a sloth, accustomed always to have its weight suspended, such exercises would come naturally; to men they involve always a certain extra amount of difficulty as compared with exercises in which the sustaining power of the legs is called into action.

I need not touch on feats in which the body is merely raised from the ground a certain number of times by the action of both arms or of one arm only, or from a single finger—as can readily be done after sufficient practice. I do not, indeed, know what is actually the "record" for feats of this sort. But for the actual lifting power of the arms, I know of no feat ever accomplished which has surpassed one which Nathalie, the lady mentioned above, was in the constant habit of performing. She could extend her body from the horizontal bar, supported only by one hand grasping the bar, knuckles downward; then (for so far the feat was not uncommon) she could put the other hand behind her and take the bar with it, holding the body horizontally by that hand. Farini told Charles Reade that he had never met with a male athlete who could do this; yet, added Reade, "it was not knack: it was complete either-handedness, coupled with gigantic strength."

Speaking of lifting the weight of the human body, I may touch here on a somewhat absurd fancy many entertain about an experiment in which four persons lift a fifth on the tips of their fingers. I have repeatedly heard this experiment spoken of as something very marvellous. The person to be lifted draws in his breath and stiffens himself generally; the four who are to lift him also draw in full breaths, "and then," the story goes on, "he is lifted without any apparent effort"—meaning, of course, that he is lifted quite easily. As, indeed, why should he not be? The person lifted usually weighs about 120 lbs., and each of the four lifters would think it no great effort to lift 30 lbs. with the forefinger. Drawing in a full breath is always a good preliminary process for any muscular effort; and after this process each of the four lifters does easily what he can always do easily, lifting not the fifth person bodily, but just a fourth portion of his weight—30 lbs., or 40 at the outside.

In all lifting feats the lower limbs are really taxed, even though the arms seem to do the work. To suppose otherwise were to make a mistake as foolish as that of the Irishman (though why such stories should be put always upon Irishmen I do not know) who thought to relieve his horse by putting the meal sacks, which formed a large portion of his load, over his own shoulders. Lift a weight how we may, the legs have to bear it. It will be understood, then, that whatever weight the arms may seem to lift in any experiment, the whole body can be made to lift much more.

In all stories of great weights which have been lifted it will be found that the lifting power of the whole body has been in question. This, indeed, is true of all the most remarkable feats of strength which have been recorded. One need not consider the feats of a Hercules (*i.e.* Herakles) or of a Samson, seeing that both one and the other is a sun-god, of whom naturally wonderful feats are narrated. (The very name Samson means the glorious sun.)

Feats actually noted and recorded are sufficiently surprising without considering feats purely mythical.

The famous strong man, Topham, of Islington, may be considered a fair illustration of those cases of exceptional development of strength — without exceptional muscular development—of which we hear from time to time, as we hear from time to time of men remarkably large or remarkably small. It would seem as though some physiological peculiarity in such men enabled them to get from their muscles much more nearly their full action than (as physiologists know) is ordinarily possible. Topham could take a kitchen poker and twist it round his neck in such sort that four or five strong men were unable to untwist it—a feat which he accomplished as readily as the twisting. He could squeeze a pewter pint-pot flat in his hand, double up a crown piece (familiarly known in former times as a "cart-wheel") with his fingers, and break a short piece of tobacco-pipe by side pressure between two fingers opened out in V-shape. This last feat, as depending on the action of muscles very seldom trained to do any work, is specially remarkable; it serves to confirm the belief that Topham was able, as it were, to charge his muscles with an exceptional supply of nerve force. They were certainly not unusually developed, though of course they were above the average size.

Van Eckeberg, an athletic German, lifted a weight of nearly 3,000 lbs. by the use of the strength of his whole body. He stood within a well-balanced framework heavily loaded, and to be raised by straps attached to a strong waistband. The lifting power was obtained by straightening his lower limbs (almost straight just before lifting). The heavily-loaded framework was thus raised an inch or two, a slight swaying movement showing the spectators that it was really free from contact with the ground.

So powerful was Topham's frame for this sort of work, that he pulled against a strong dray horse—his body being in a horizontal position, and the pull of the horse being resisted by the pressure of his feet against two stirrups, so that the action was akin to that of Van Eckeberg's in the lifting experiment. Unfortunately, after he had successfully resisted the pull of one horse in this way, he had one of his knees shattered in an attempt to pull against two horses, and thereafter he was disabled from the performance of feats of this kind. Great care indeed is required in all lifting exercises to avoid any sudden change in the direction of the pull.

The secret of this great lifting power of the legs in such work lies in the fact that the action has that exceedingly effective leverage which is employed in the Stanhope Press—familiarly known, in fact, for this very reason, as "knee leverage." When the legs are nearly upright the knees may be perhaps half a foot from the position they take when the legs are straightened. While they move through this half foot the body is not raised more than perhaps half an inch; consequently the power used in straightening the legs is multiplied into a twelve-fold greater lifting power. It is because of this powerful knee-straightening action that lifting exercises are apt to develop abnormally the muscles of the lower and inner end of the front thigh.

To lift a thousand pounds on the health-lift is no very remarkable feat for a person of average strength, giving sufficient time daily for a few months to practice. Mr. Blaikie learned in this way, at the age of seventeen, to lift a thousand pounds after only six months' practice. Those who prefer to lift an actually measured weight will find it necessary to adopt some such plan as was employed by Topham, preparing a framework to bear the weight, and standing in its midst so as to lift the weight by means of symmetrically-attached straps. For the body cannot, when all aslant, bear such a weight as a thousand pounds.

Whether such exercise is good for the body as a whole depends a good deal on the opportunities which a man has for correcting an abnormal development of the lifting muscles by means of other exercises, increasing the development of other muscles and giving activity as well as strength to the frame.

NOTES ON AMERICANISMS.

Habitan. Corruption for the French word *habitant*, a landed proprietor on a small scale. The word is seldom heard outside Canada on the northern side, and Louisiana on the southern. When heard in the middle States, it usually has a sound as entirely different from the French pronunciation as "Movey Star" is different from "Mauvaises Terres," or "Lagrange" (rhyming with "range") from the French "Lagrange."

Had have, Hadn't oughter, and kindred combinations and abominations are heard about as frequently in the States as in the old country. Would that Bartlett "had have" been justified in implying that Americans only use expressions which they "hadn't oughter" such as these.

Hail from, To. The good old sea-phrase, "hail from" for *come from, belong to*, is heard in America as in England, though America has done her best to destroy her own sea-carrying trade. But to call "Hail from," thus used, an Americanism, is as absurd as it is to call "Hang out," for *live inside*, American. Bartlett naturally does both, seeming to know as much about English usage as the *Saturday Review* knows about Americanisms.

Hammock. 1. The use of this word for a swinging-bed, though of South American origin (Spanish *Jamaca*) has now been for more than a century so widespread that to regard it as an Americanism would be absurd. The use of the "hammock" as an open-air couch in gardens, on porches, and so forth, is, however, undoubtedly much more common in America than in the old country, the summer climate inviting to lazy ways of lying (or "laying," as nine-tenths even of the "society people" of America call it), reclining, sitting, and so forth. The grandsons—aye, and the sons, too—of men who in England would be ashamed to be lolling and sprawling half the time, loll and sprawl all the time in America. But for the constant infusion of new blood, the American population would develop in a few generations into a race no longer using chairs, except of the lazily rocking sort, and regarding the upright position as involving an exhausting tax on the energies.

2. The word *Hammock* is used in the Southern States, for "a piece of ground thickly wooded, whether a prairie or a hill, and distinguished from the immense forests of thinly scattered pines, which with a few exceptions cover the whole face of the country" (where the word "hammock" is in vogue). This definition is from an article in the *North American Review*. The word is not found in either Webster or Worcester. I can find no evidence as to its origin, since it is clearly quite distinct from the old word "hummock" for rounded knolls. It is painful to have to admit ignorance about an Americanism, with the *Saturday Review* ready to pounce on every indication of my having undertaken in these "notes" a task for which I am totally unfitted. I may, however, remark that even as I had been myself using for years two of the Americanisms which that omniscient weekly strove to exploit as "recent inventions," I know by actual experience what "hammock land" is, though I am unable to say how the word "hammock" came into use. I write these lines with half-a-dozen tracts of hammock land in view, and with one such tract within five minutes' walk, a portion of which has been cleared away for my own special "potato patch" (the "potato" growing on it being at present grape vines, however). I must ask the readers of these "notes" to excuse me for occasionally reminding them that I have had (and have) somewhat exceptional opportunities for comparing American with English expressions and ways. I should not have thought of so doing had not the greatly daring review which has recently made itself for ever famous by attributing to Sir William Jenner the invention of vaccination—when he was presumably a very young man, a century ago—written of my modest "notes" in terms implying that they had been evolved from my moral or immoral consciousness. Yet are there some things, strange to say, which the average *Saturday Review* writer really does know, and know by the best of all possible evidence, and among these is the fact that some writers would for a consideration pen a treatise about the Himalayan Snows, with no wider experience than a back attic in Grubb Street would afford, or discuss the campaigns of Napoleon or of Moltke with no better knowledge of the military art than may be obtained in school-boy scrimmages.

Hand.—It will hardly be believed that Bartlett includes the expression "hand" used in reference to proficiency—as when we say that a man is a "good hand" at fighting, or a "poor hand" at accounts—among Americanisms; but he *does!*

Handsome for *generous*, is of course as thoroughly English as any usage can well be. But Bartlett who includes this usage among Americanisms, overlooks an expression which, though occasionally heard in England, is so much more commonly heard in America, that it might well have been one of Bartlett's set. In America the expression "he did the thing handsome" would not be thought remarkable, though a small percentage might be aware that it is incorrect.

Hang. To get the "hang" of anything, meaning to learn its nature and peculiarities, is an expression which has long been in use in the old country, but is perhaps oftener heard in America.

Hang, Around, To, signifying to loiter about, is only an Americanism in regard to the word "around," which is used here where in England we should say "about" or "round." I am inclined to think that the word "around" constantly used in America where we say "round," is in reality the more correct adverbial form, "round" being a corruption by clipping, which in strictness should be written "'round." I have myself become so accustomed to the American usage that I have found the word "around" making its appearance frequently in my writing, insomuch that an English friend of mine who is kindly helping me in the revision of my "Old and New Astronomy" has had occasion to alter "around" into the more usual "round" in quite a number of places. I was thus led to examine my earlier works, written before I had lived in America, as I have during about six years out of the last fifteen, partly expecting to find that I used the word "around" as freely then as now. But in my "Saturn and its System" I find that where I should now be apt to write "around" I wrote either "about" or "round," the

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former much the more frequently, probably because the word "about" is constantly used in mathematical works when rotation or revolution is in question. In passing, I may remark that my first acquaintance with the American usage was formed when (somewhere about the year 1855) I heard Mrs. Florence as the "Yankee Gal" singing the well-known song "Bobbin' Around." But the refrain "As we went bobbin' around," familiar though it became, did not so far affect my English as to make me write of Saturn as bobbin' around the sun. He still continued sedately, even Saturninely, to "revolve about" the ruler of the solar system.

Hang Out, To. Bartlett not only regards this as an Americanism, but identifies it as Western, almost as Chicagoese. It was already old in England before Chicago began to be a place. Those elegant medical students, Messrs. Bob Sawyer and Benjamin Allen, could have enlightened Mr. Bartlett more than half a century ago about this bit of old English slang.

Hang Up One's Fiddle, To. To give up; an expression frequently heard in the Middle and Northern States, but probably of southern (nigger) origin. "Hang up um fiddle and um bow-ow-ow" will be recognised as part of the refrain of a very ancient nigger song.

Happen in, To. To come in accidentally, short for "to happen to come in."

Happen on, To. To happen to meet, short for "to happen to come upon" such and such a person. The later, but now not very recent, Americanism for this idea, is "to strike." Where of old a man would say, "I happened to come on our friend Mr. Jones yesterday," an American would formerly have said (and many Americans would still say), "I happened on friend Jones yesterday," while an American of to-day, especially if a westerner, would be apt to say, "I struck Jones yesterday."

Hard Case. A term not unknown to the British police for an irreclaimable criminal, extended as an Americanism to hopeless rakes, blackguards, drunkards, poker-players, *et id genus omne*.

Hard Pan. Bartlett describes this as primarily a geological term; but though a geologist may occasionally speak of a hard and water-tight stratum of hollow shape as a hard pan of clay or gravel, or describe such a stratum as the hard pan below such and such strata, yet the term "hard pan" has not in this indefinite form yet taken its place in the geological vocabulary. "Hard pan" as an Americanism, signifying the bottom of things, is doubtless derived from mining experience. A man might dig for gold through stratum after stratum without altogether losing hope, till he came down to the hard water-tight stratum below; but when he had thus reached "hard pan" he gave up. To say, then, "We are coming to 'hard pan,'" or "we have now reached 'hard pan,'" is equivalent to saying, We are now beginning to know with certainty, or we can now form a definite opinion. The idea is more poetically expressed, but with the same inner significance, in Wordsworth's well-worn lines:—

> To the solid ground of nature
> Trusts the mind that builds for aye.

Hard Row to Hoe, A. A tough business to get through. Haliburton has made us familiar with this expression as an Americanism, but it may be regarded as surely of English agricultural origin.

Hardshell, used as an adjective for thorough-going, is probably a pure Americanism, since the term was originally suggested as the difference between the hardshell and soft-shell crab, and we have no soft-shell crabs in the old country.

(*To be continued.*)

THE STARS OF OTHER TIMES.

(*Continued from page* 112.)

THE southern stereographic map in the present number needs no separate explanation, being drawn on the same plan as the northern, and having the same general interpretation.

It is, however, altogether the more interesting map of the two. The stars north of the ecliptic have always been visible up to about 66° 30′ north latitude, and the stars in the northern map, which ranges 10° south of the ecliptic, have been always visible, at suitable times and seasons, as far north as about 56° 30′. But stars shown in the southern map are for the most part such as are only brought into view in northern latitudes by the slow precessional motion of the equator along the ecliptic, and after being thus in view for a time—hundreds, or it may be thousands of years, according to their position on the star-sphere—are carried out of view again, so as to be unknown in the latitudes where they had so long been known, during hundreds of future generations. Moreover, the aspect of the southern star groupings as they rise to their greatest height above the horizon of northern latitudes, changes continuously with the precessional movement, much as the aspect of northern star-groupings changes during the night. As Cassiopeia and Andromeda, for example, Auriga, Bootes, and Cepheus, are sometimes presented in such positions that the figures associated with them have the uprightness desirable with men and women, but at other times are aslant or inverted, prone or supine, so the ship Argo and the altar Ara have held very different positions at their culmination in past times than now, and will continue slowly to change in position as the precessional motion continues.

Doubtless it is due to such changes as these that several southern constellations are no longer recognisable from any resemblance between their configuration and such objects as altars, ships, animals, and men. For a star-grouping which will readily suggest to the imaginative mind the idea of some known object when that object, so imagined, would be in a natural attitude, will suggest no such idea in any other position. To see this we have only to consider the case of the constellation Orion. In one position this grand star-group suggests the idea of a giant holding a shield of some sort in front of him, and standing upright, while in another it suggests the idea of the giant raising himself towards the upright position, and in yet another, that of the giant slanting forwards as if running down a slope. But seen near the horizon at the equator, when the giant would have to be imagined either prone or supine (supine in the east and prone in the west), the constellation does not suggest the idea of a man at all; while in the southern hemisphere, though the idea of a giant is again suggested, it is a giant of another figure and presented in a different way, the shoulders of our northern Orion representing the knees of the southern giant, and *vice versa*.

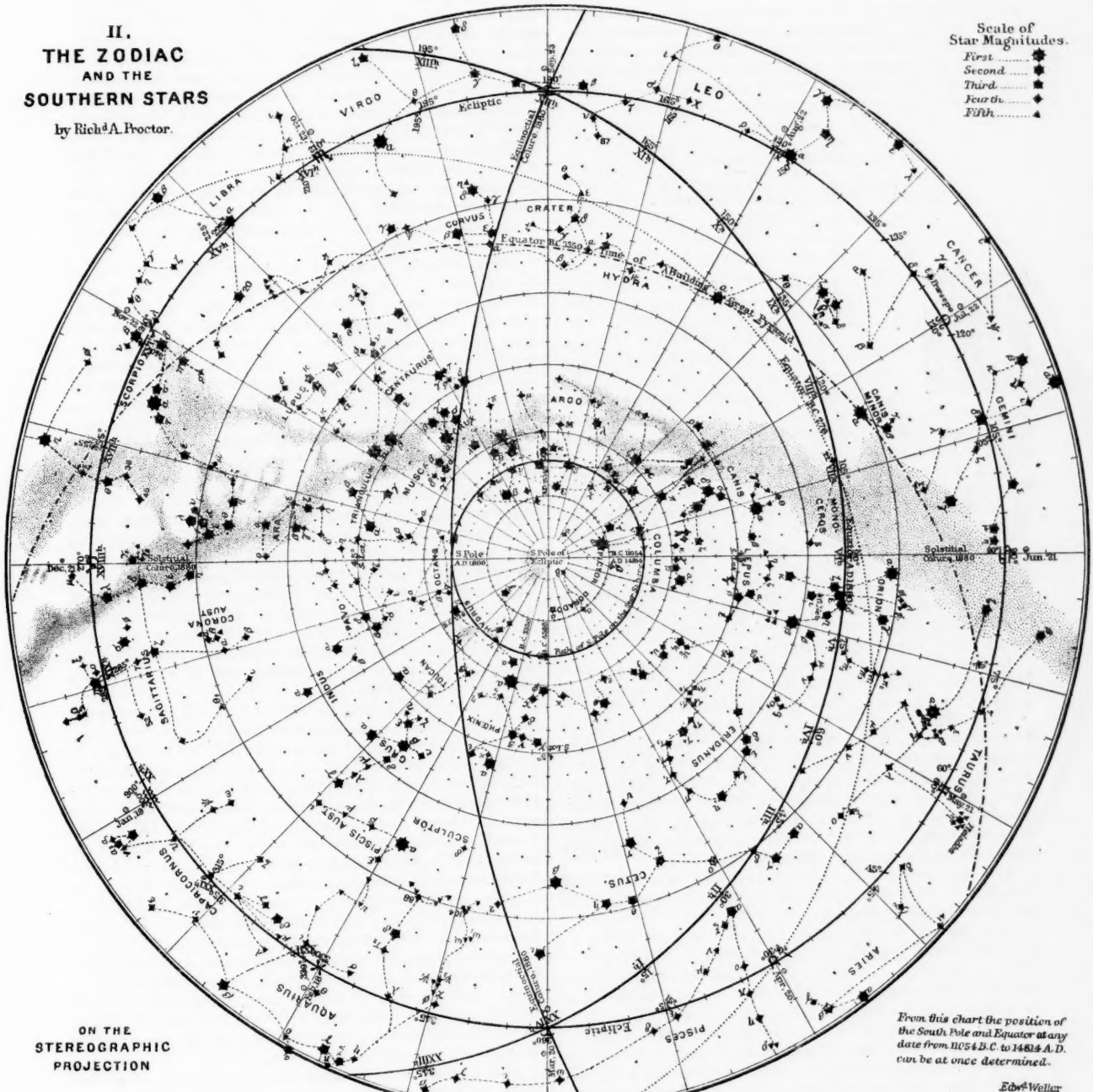
Thus it becomes a problem of some interest to determine how the star-groupings associated with different objects and figures appeared when those particular constellations received their names: for thus not only may we be able to correct our determination of the date of such naming, but we may obtain evidence more or less satisfactory respecting the occurrence of changes among the stars, we may be able to find some explanation of the ideas of men in old times respecting the constellations, and we may even be able to find an interpretation of certain religions which were associated in far-off times with the stars.

The study of the southern star-chart will serve to show

II.

THE ZODIAC AND THE SOUTHERN STARS

by Richd A. Proctor.



ON THE STEREOGRAPHIC PROJECTION

From this chart the position of the South Pole and Equator at any date from 11054 B.C. to 14824 A.D. can be at once determined.

Edwd Weller

how the celestial equator was situate with respect to the southern constellations—(1) at the time corresponding to the building of the Great Pyramid, and (2) in the days of the early Greek astronomers. I would invite special attention to the position of the ship Argo, which was horizontal when culminating at the former epoch, aslant in the days of Hipparchus and Ptolemy, and is now more aslant still. As a ship may be said to be in her natural position when on an even keel, we have in this result evidence of some force to show that the constellation received its name at the earlier period, or more than 3,000 years before the Christian era. At any rate, further inquiry into this question is suggested.

(*To be continued.*)

EVOLUTION OF LANGUAGE.

By Ada S. Ballin.

X.—ROOTS AND THEIR USES.

AVING spoken of the probable origin of a large number of roots, we can now turn with interest to the use of roots in the various languages known to us. As Mr. Garnett announced in 1849, after a searching analysis of more than eighty languages, word endings were originally uninflected pronominal roots, with a locative signification. Roots are all that is primitive in language, and sentences are even now found wholly composed of these elements.

In a private letter to me, Mr. Frederick H. Balfour—than whom few are more familiar with the Chinese language and its dialects, as used at the present day, as well as with the classical or literary language—once observed: "I may safely say that it would be difficult to write one sentence which did not consist of roots, for every character embodies a root idea, and is used for ordinary purposes, in literature as well as conversation, without inflection."

According to the manner in which roots are combined, we find three stages of language:—

I. The radical, in which, as in Chinese, roots are used independently, supplying the place of all parts of speech, as *ì chang*, "employ stick," meaning "with a stick."

II. The agglutinative, in which two roots may be joined to form a word, in which compound one root may lose its independence, the stage called by Max Müller, to whom this classification of language is due, the terminational, exemplified by the Turanian family, in which the root stands out clear from the termination, as, for example, from the Turkish root *bakar*, to regard, we have *bakar-im*, *bakar-sin*, and so in conjugating the verb.

III. The inflectional, in which two roots may be joined together to form words, both losing their independence in Aryan and Semitic languages.

As long as every word or part of a word is felt to express its own radical meaning, a language belongs to the first or radical stage. As a specimen of this stage, Chinese is the stock example; but although it is always regarded as a monosyllabic language, a large proportion of its parts of speech are formed of two characters (root words) joined or used in apposition, each of which supplements and explains the other. The combination thus effected presents a distinct dissyllable. As Sumner says:—"A word in Chinese *may* consist of *one* syllable, but, from the want of grammatical inflections, and from the limited number of syllables in use, a monosyllable is rarely intelligible when alone; it generally requires some adjunct to limit or strengthen its meaning."

Chinese words have neither classification nor inflection, and distinctions of case, number, person, tense, mood, and so on, are non-existent. The meaning of a character or word, and its place in the sentence, generally determines to what category of our grammar it belongs; but frequently auxiliary syllables and particles distinguish the parts of speech. The syllables which serve to strengthen the original notion expressed by the chief syllable denote the *agent*, an *object*, the *completion* or *expansion* of the chief idea, or "are purely *formative* in character, and produce nouns or verbs, adverbs or adjectives, as conventional usage has determined."* A noun, from its position, may become a verb, or it may so stand with another noun as to signify a preposition. Thus *hiá-shān*, "descend a mountain"; *hiá-fāng*, "lower room"; *shán-hiá*, "at the foot of a mountain," *hiá* in other combinations meaning "below"; *waí*, "exterior"; *waí-kwŏ*, "foreign countries"; *kwŏ-waí*, "out of the country." The Chinese word cannot therefore be regarded as really either noun, verb, or other part of speech, since, under different conditions, but without any change in itself, it may come to represent each in turn.

Chinese words which may be classed under our head of nouns, as far as regards their use or derivation, may be divided into three kinds:—1. Primitive nouns, monosyllables bearing their original signification, and generally used in the monosyllabic or crude form, such as *jîn*, "man"; *fán*, "rice"; *ch'â*, "tea." The class is not a large one, and the monosyllables are not understood by the Chinese when pronounced separately, being only used in connection with other words—as "a man," *yĭ-kó* (one), *jîn*; *k'ĭ-fán*, "to eat rice" = "to dine"; *tsaù-fán*, "early rice" = "breakfast"; or *wán-fán*, "late rice" = "dinner"; and so on.

2. Nouns derivative, made by the addition of one or more formative syllables—a much more numerous class, which always remain nouns, while some of the former class may be used as verbs. The formative syllables in these nouns serve the same purpose as terminations in inflectional languages. Thus *jîn*, man; *kūng-jîn*, a workman; *sheù*, hand; *shwuì-sheù*, "water hand," a sailor; *ûr*, infant; *nû-ûr*, "a girl"; *jîn-ûr*, "a man"; *kiā*, "family"; *jîn-kiā*, "people." 3. Composite nouns, which are formed by the connection of two or three syllables, each of which retains its proper signification.

The same syllable may be repeated, as *naī-naī*, "married lady of rank"; or synonyms may be united, as *sîn-châng*, "the heart, the feelings"; or a noun may be formed of two verbs, as *hîng-weî*, "actions," from two words meaning, 'to do." Nouns expressing the abstract notions of verbs are generally formed in this latter way, just as the infinitive is used in Greek and German—τὸ τυχεῖν, das Leben, das Haben, and so on. Two adjectives are united to form nouns, as *chīn-paù*, "precious-precious"=a jewel; *yiú-mún*, "sad-sorrowful"=sorrow. Many nouns are formed by placing generic terms, as, for example, the equivalents for *tree*, *stone*, *fish*, &c., after the special object; as we say *limestone*, *fir-tree*, and the like. Words expressive of time and place, generally used as prepositions or adverbs, also enter into the composition of nouns, as in the former examples: *tsaù-fán*, "early rice"; Ger., *Früh-stück*, "early piece"; *wán-fán*, "late rice"; Ger., *Abend-brod*, "evening bread," for the evening meal, supper; *kīn-jĭ*, "now-day"=to-day. Cf. the uses of νῦν and πάλαι.

The modes of expressing abstract notions are exceedingly interesting. A common method is to combine opposites, as "light-heavy"=weight, "many-few"=quantity, "long-short"=length, "high-low"=height, and so on. Others are formed by the addition of such words as *hi'ĭ*, breath; *fūng*, wind; *sīn*, heart; *sîng*, nature, disposition, faculty: thus—*i-k'ĭ*, integrity; *liáng-sīn*, conscience;

* Sumner's "Handbook of the Chinese Language," p. 41.

mîn-fûng, nationality; *mán-k'í*, sadness. Others are formed in the same way as the other nouns mentioned above: thus *maĭ-maĭ*, "to buy—to sell"=trade; *fán-pĭ*, "to divide—to distinguish"=difference; *siaù-sîn*, "little-heart"=attention, and so on.

Diminutives are formed by the addition of words signifying "little" or "small," "child" and "infant." The distinctions of gender and number are similarly made by words prefixed or suffixed to the principal word, *nâu* male, and *nŭ* female being prefixed to *jîn* to express the gender of the person spoken of, and *kūng* "male," and *mù* "mother" to names of animals, in order to distinguish their gender. The plural is expressed by the reduplication of the word, by prefixing some syllable meaning "all," "many," or "class," or by employing a numeral. The only case which can be distinguished by the form of the expression is the *genitive*, indicated by the particles *tĭ* in speaking, and *chī* in books; these are by nature demonstratives, and stand for the English apostrophe s, 's or s'.

Chinese adjectives may be divided into three classes in the same way as nouns; some may be looked upon as primitive, being seldom used in any but an adjectival relation, for example *haú*, "good" is generally used as an adjective, though, with a change of tone, it is *haú*, "to love."

Some monosyllables are used as verbs; but they are almost always assisted by some other syllable of cognate meaning, and thus the spoken language of China is polysyllabic rather than monosyllabic, as it is usually supposed to be. There is no distinction between *active* and *passive*, *person* and *number*, the context guiding to the meaning, and *mode* and *time* are similarly shown by the context and the conditions under which the sentence is spoken. The composition of verbs is similar to that of nouns, they being formed by (*a*) repetition as *k'áu-k'áu* "look, *look*"=*look*; (*b*) by joining an auxiliary to the primitive, as *tiĕ-sź*, "fall, die"= fall down dead; (*c*) by prefixing to one verb another denoting *power*, *origin*, *desire*, *intention*, &c., as *k'ì*, "arise, begin," *k'ì-tsó*, "begin to do"; (*d*) by placing verbs before or after others to denote intention or completion of the action, as *liaú*, to finish, *sź-liaú*, "is or was dead," *ì*, "already," *ì-chí*, "has arrived"; thus the past tense is expressed, and the future may be indicated by the addition of syllables meaning *wish*, *approach*, *certainly*, and the like, thus, "wish go" for *will* or *shall go*, "approach do" for *shall do* or *about to do*, "certainly walk" for *shall walk* or *must walk*; (*e*) by uniting two verbs as in (*b*), but the union of which gives a different meaning to its parts, as *kĭ-tĭ*, "to record, obtain"= *to remember*, *tseù-k'aī*, "walk open"= *to walk away*; (*f*) by adding the proper object to the verb, like the cognate accusative in Greek, a new verb being thus formed, as *kĭ* or *chĭ-ján*, "eat rice," for *eat* (any meal), *t'īng-mîng*, "listen to, order"= *obey*; there are still other forms, but these sufficiently indicate the system. Many nouns are used as verbs, the context only determining to which part of speech they belong; these are always monosyllables, as *tiēn*=*a point*, *dot*, also *to punctuate*, *to blot out*, *to light*, *to nod*; *taú*=*a road*, *reason*, also *to say*; *schwŏ-kwá*=*conversation*, also *to talk*.

By a change in tone when speaking, the *voice* and kind of the verb may be changed, an *active* verb becoming *passive*, or a *transitive neuter* or *causative*—as *weî*, "to make, to do," changes into *weí*, "to be made," "to be considered as."

A verb standing alone or as the first word in a clause generally serves as an imperative. The imperative is also marked by auxiliaries, signifying to *invite* or *bey*, to *cause*, *call*, *exhort*, and the like. The *passive* voice is sometimes expressed by auxiliaries, meaning "to receive," "to meet with," "to suffer," and so on.

In Chinese, then, the roots, although combined to express one idea, maintain their individuality of form, but signs are not wanting to show that even here the same agencies are at work which have brought other languages to the agglutinative stage in which the meaning of one root is lost, so that in the formation of the new word it becomes a mere appendage. Thus in Chinese "ten" is *shĭ*, and "two" is *ár*, for "twenty" the two are joined, and we have *ár-shĭ*; this process is clear, but a knowledge of the structure of language enables us to perceive that *twenty* was also originally *two* × *ten*. In Chinese what corresponds to our locative is formed in several ways, as by adding such words as *chūng*, the middle, or *nüí*, inside. An old word *ì*, meaning to *use*, forms the instrumental, as the classical *i chang*, with a stick. In Sanscrit every substantive has a locative—for example, *hṛid* heart, *hṛidi* in the heart, the short *i* representing the same root which produced the preposition *in*, so that, like the similar Chinese usage, *hṛidi* meant literally *heart-within*. Other cases and the various forms of the verb have been shown to have arisen in the same manner.

As soon as such words as *li* in *úŏ-li*, "at home," *li* originally meaning "interior," in, or *ī* in *ī chang*, with a stick, lose their etymological meaning, and become mere signs of derivation or of case, language enters on the second or terminational stage. By far the largest number of languages belong to this stage.

Thus in Chinese, and more especially in some of its dialects, a rudimentary form of agglutination may be observed. Modern Chinese are not aware that the locative suffix *li*, as in *úŏ-li*, originally meant "interior," and in the Shanghai dialect *wo* is to speak as a verb; *woda*, a noun "word" with *wodaka*, used like our genitive; *tang-woda* as accusative, and *pela woda* as a dative. Similarly in agglutinative languages traces of inflection have been discovered. There is partial blending of termination and root in some Kalmuck dialects, and in Tamil the derivative *tûkham*, "sleep," has not retained the proper form of its root *tûngā*, while in Turkish still further advances towards inflectional forms have been made.

STRANGE WHIST HAND.

By Richard A. Proctor.

I OBSERVE that many English papers contain an account of a case in which the dealer at whist held all the trumps—and all repeat the mistake of asserting that according to Professor Pole the chance of such an event is but one in 639,013,559,600. I feel sure Professor Pole never fell into such a mistake. The chance is really one in 158,753,389,900; but the *à priori* probability that any player will hold thirteen cards *of a named suit* is that quoted from some misunderstood statement of Professor Pole's. The subject is dealt with fully at pp. 190, and 194–197, in my "How to Play Whist," under the title "Whist Whittlings."

It is also a mistake to suppose that because there is but one case among 158,753,389,900 possible dealings at whist in which all the trumps go to the dealer, therefore so many trials would be required to give an even chance of such an event. To illustrate the fallacy underlying such a statement—there are two possible events in coin tossing, but it does not require two trials to give an even chance of tossing head. *Half that number suffices.* In articles of mine on Probabilities in former numbers of Knowledge, this point is fully considered, and the proper ratio determined.

I may touch on these points again in "Our Whist Column" later.

XUM

METEOR BIRTH OF THE UNIVERSE.

A SOMEWHAT surprising communication (see the last paragraph of this article) has been recently addressed by Mr. J. N. Lockyer to the Royal Society on the subject of the probable origin of the universe from meteoric aggregation. A brief account of the history of this theory from its inception to the present time may serve at once to interest readers and to show in what respect the latest communication on the subject is chiefly remarkable.

In 1848, long before the knowledge respecting meteors had been obtained which has recently thrown such interesting light on their importance in the universe, Dr. Mayer, of Heilbronn, enunciated the theory that the sun's heat is due to the constant indraught of meteoric matter upon the ruling centre of the solar system. This theory involved implicitly the theory that, besides our own sun, all his fellow-suns, the stars, owe their light and heat to meteoric aggregation. Nay, it had to be extended still more widely to include such heat as once pervaded the frames of all the members of the solar system—giant planets, terrestrial planets, aerolites, and satellites—as well as the heat which in like manner pervaded, millions of years ago, the masses of all the orbs circling in system around all the thousands of millions of suns constituting our galaxy. While, also, beyond our own sidereal system all the other similar systems which doubtless pervade the infinitudes of space must presumably (if Mayer's theory were accepted) owe their light and heat—in other words, their life—to meteoric collisions.

Mayer's theory has not secured acceptance in its original form. Supported for a while by Sir W. Thomson, Mr. Joule, and other leading mathematicians and physicists, it was rejected by astronomers, who knew from the motions of the planets that there is not a sufficiency of ungathered material within the solar system to account for more than ten years' emission of solar heat. Yet in another form the theory has been accepted as affording practically the only feasible explanation of the sun's heat. We now regard the heat of the great central luminary as almost wholly due to the action of gravity on the component materials of the sun's mass, that heat being in technical terms the thermal equivalent of the mechanical energy expended in the process of solar contraction. Grant only that the sun's whole mass was produced by a process of meteoric aggregation, and we perceive that this theory of the origin of solar—and therefore of stellar and planetary—heat is simply a development of Dr. Mayer's meteoric theory.

Recognising this, I could not advance as original the theory which I have presented and discussed in the chapter on "Comets and Meteors" in my "Other Worlds than Ours," though much of the evidence was considered there for the first time, and details of the theory as I advanced it were entirely original. I there showed that, whereas the nebular theory of Laplace (which was advanced by that great mathematician merely as a hypothesis) affords no explanation whatever of the strange way in which the masses of the solar system are distributed, the theory of meteoric aggregation gives a very fair account of all the leading features of the system, from the surpassing mass of Jupiter to the insignificant combined mass of the thousands of small planets which travel in a zone next within the orbit of the chief giant of the solar system.

But in the meantime, as also since 1870, when my own first discussion of the meteoric theory of the birth of our solar system appeared, discoveries most interesting and important in character had been and have been in progress. Some of these I have myself discussed at length in these columns; and even if I had not I could not find space to discuss them here. Let it suffice to mention the leading names and the discoveries of chief interest. In America Professor Newton, of Yale College, called special attention to the significance of the periodicity of the November meteors; and through his researches, combined with those of Schiaparelli, Adams, Alexander Herschel, and many others, it has been established that meteor systems play an altogether more important part in the economy of the solar system than had formerly been imagined. The connection between falling-stars, meteors, fire-balls, and aerolites was also satisfactorily demonstrated, a discovery by which the importance of these various orders of bodies in the universe, considered alike with reference to space and to time, was still further indicated. The microscopical studies of Sorby, the English mineralogist, and the chemical studies of Graham, the chemist, showed the structure of meteorites to be akin to what we must regard as the probable structure of the material forming the sun's mass. M. Stanislas Meunier and Daubrée in France indicated at once the varieties of structure, microscopical, chemical, and physical, existing among meteorites, and the identity of each one of these varieties with some variety recognised among terrestrial materials, especially among materials found deep within the crust of the earth. As the oneness of structure existing within the solar system, and indeed within the universe itself, has long ago been recognised, we may regard these researches and the kindred researches of Dewar, Tschermak, and others, as comprising the general theory that all the discrete masses in the universe, from the largest suns to the smallest satellite, are products of meteoric aggregation.

A very important part of the evidence in favour of the theory that all the orbs in the universe were thus formed has always been recognised in the variety of character recognised in the stars as analysed with the spectroscope. Rutherfurd in this country, Secchi, Miller, Huggins, and Vogel in Europe, have shown that the stars may be arranged in classes, indicating varieties of temperature ranging from heat producing only the faintest luminosity to the transcendent heat of the giant suns whose whole masses seem vaporised, if even (as Professor Clarke, of Cincinnati, suggested) the very elements, as we consider them, are not dissociated into the true elements of which they are in reality compounded. This, of course, is what we should expect to follow from the immense range of variety in regard to mass existing in the universe of suns. If these orbs owe their heat to the combined processes of meteoric aggregation and contraction, it must necessarily follow that the larger masses will be the hotter, not only as pervaded primarily by a more intense heat, but as parting more slowly with their heat than smaller masses. (They would give out more heat absolutely, moment by moment, but less relatively to the totality of heat pervading their orbs.)

Thus the theory of meteoric aggregation as suggesting the true method of cosmogonic evolution has long had a great mass of evidence, very varied in character, in its favour. On the other hand, it is open to none of those physical objections which oppose themselves persistently and with overwhelming weight against the nebular theory of Laplace. It requires us to believe in no such unthinkable impossibility as a vast disc of infinitely tenuous vapour presenting all the characteristics of a practically infinite rigidity. This indeed is the merest beginning of the difficulties besetting Laplace's hypothesis—difficulties not recognisable in his day, though he seems to have felt something of their force when he remarked that he presented the hypothesis "avec la défiance que doit inspirer tout ce qui n'est point un résultat de l'observation ou du calcul."

What the great master of mathematical astronomy thus advanced with caution, and even with mistrust, is by the less informed in our time urged with confidence amounting to daring. "Fools rush in"—"the proverb is something musty."

The theory of the meteoric origin of the universe is interesting and attractive, if not in some aspects imposing and almost awful. It has been so long before the scientific world that Mr. Lockyer's manner of advancing it as a new cosmogony must be regarded as awfully imposing in another sense. We may, however, regard Mr. Lockyer's adoption of the theory (like his former absorption of Professor Clarke's fine theory of the probably compound nature of the so-called elements) as indicating the approaching acceptance of the theory by the public at large as well as by the students of science.

THE AMERICAN TROTTING-HORSE.

PROFESSOR WILLIAM H. BREWER, in a paper on the "Evolution of the American Trotting-Horse," shows that the trotter is an American product, and that it is still in process of evolution. He gives a column of figures to show the speed that has been attained in this new form of motion, from a speed of three minutes in 1818 down to two minutes ten and a quarter seconds in 1881. The materials for a curve are offered to mathematicians, and Professor Francis E. Nipher ("American Journal of Science and Arts," vol. xxvi., p. 378), in a mathematical article on the subject, shows that a definite time of ninety-one seconds will ultimately be attained by the American trotter! Mr. W. H. Pickering ("St. Louis Academy of Sciences," May 7, 1883; also "American Journal of Science and Arts," vol. xxvi., p. 20), however, urges some objections to the deductions of Professor Nipher.—*Popular Science Monthly.*

OYSTER PROTECTION.

THE great problem of food-supply has led to legislative enactments for the purposes of regulating the trapping and netting of game and fish. State and Government grants have been made for fish commissions; but, unless the public are clearly educated in the rudiments of zoological science and the principles of natural selection, appropriations will come tardily and in limited amounts. Dr. W. K. Brooks, in his report to the State of Maryland as one of the oyster commissioners, after showing the absurd way in which the problem of oyster-protection has been dealt with, and strenuously urging the necessity of oyster-culture, calls attention to the fact that "civilised races have long recognised the fact that the true remedy is not to limit the demand, but rather to increase the supply of food, by rearing domestic sheep and cattle and poultry in place of wild deer and buffaloes and turkeys, and by cultivating the ground instead of searching for natural fruits and seeds of the forests and swamps." Mr. Ernest Ingersoll, author of the "Report on the Oyster Industry," tenth United States census, has, in an address before the Geographical Society of New York, a striking sketch of the effect of the white man on the wild animals of North America, showing that, had the Indians remained in possession, little if any change would have taken place. The Indian, like the predaceous animals, hunts only for food, and shows even in this habit a wholesome self-restraint, never killing wantonly. He called attention to the survival of a number of small birds about the dwellings of man as the result of favourable conditions, such as a constant supply of food, &c. He shows that the contact of man in the main has been disastrous. His remarks on the oyster are timely; he shows its extermination along the coast by man's agency. "Hardly more than a century has elapsed since men believed that the oyster-beds of New York were inexhaustible, and that a small measure of legal protection, feebly maintained, was quite enough to sustain them against any chance of decay. So they thought in Massachusetts, where the oysters have not only disappeared but have been forgotten. So they think now in Maryland and Virginia, where their fond expectations are destined to equal downfall."—Professor E. S. Morse, in the *Popular Science Monthly.*

THE ANCIENT HISTORY OF THE MAORI.*

MAORI means "native," but the Maori are not the aboriginal dwellers in New Zealand. As near as the traditions which recount the generations of chiefs enable us to reckon, between four and five centuries have elapsed since the immigration from Hawaiki, by which Meinicke says is meant the mythical land of origin of the whole Polynesian race, and not any particular island, although the affinities of the Maori language point to Raratonga. These traditions agree as to the discovery of New Zealand by Kupe, a native of Hawaiki, who formed an expedition of thirteen canoes and ventured across the ocean, and to those canoes the several tribal divisions appear to correspond.

The Malayo-Polynesian origin of the Maori is beyond question, the differences now existing between them and kindred races of the Pacific being due to intermingling with the aborigines, who were of the lower Papuan type, and markedly inferior both in bodily and mental capacity to their conquerors. These have in their turn, not without a fierce struggle, succumbed to the British arms; their decay set in fifty years ago, and their ultimate extinction is only a question of time, so that the task which Mr. White, following in the wake of Sir George Grey, Taylor, Buller, Bastian, and others, has set himself in collecting traditions of no small value, however adulterated and fragmentary as some of them may be, will secure him the gratitude of anthropologists. His book is for students, and they alone can rightly assess the worth of his labours, but the material gathered will filter through them to the general reader, to whom meanwhile some idea of the contents of this volume may be acceptable. The task undertaken in it and in the volumes which are to follow is "no less than to give the Maori traditions of his race as they relate to the creation of the world, the origin of its animal and vegetable life, the ancient wars in the home of his ancestors, the migrations and perils and arrivals of the several canoes in New Zealand, the people they found here, and the territory they respectively occupied; the names given to the mountains, rivers, headlands, and their meaning; the tales of folk-lore, of fairies, ghosts, and spirits, of the monsters of the earth and sky; his traditions relating to the art of tattooing, and the ceremonies connected with births, marriages, deaths,

* "The Ancient History of the Maori." Vol. I.: Taki-Tumu Migration. By John White. (Wellington: Government Press; London: Colonial Booksellers' Agency.)

and tapu,* and the songs and proverbs of his people," the text being given as well as the translation.

Such were the themes on which, sitting under a shady tree, the priests of the old faith discoursed to Mr. White, daring "to disclose some of their sacred lore," but leaving blanks now and then which no logic or persuasion could induce them to fill. "The parts I have not related," said one, "are so sacred that I withhold them in dread of sudden death." "I cannot give some of our sacred history," said another, "as not an old priest now remains alive who has the power to perform the ceremonies to save me from the penalty of divulging the sacred words of the gods." The extreme care with which the ancient legends were guarded so as to secure their unimpaired transmission, the existence of an hereditary caste which was the vehicle of the sacred oracles, are among the many evidences of a highly-organised social state, which, however, existed side by side with insatiate cannibalism. The chapter in which Mr. White describes the Whare-Kura, or sacred school in which the eldest sons of the priests were taught mythology and history, as also the rites and incantations of the craft, is full of interest. Besides this school of divinity, there were schools of astronomy, in which the study of omens to be drawn from the movements of the heavenly bodies was practised, and schools of agriculture and manufactures, all of which were open to every class. In the Taki-Tumu traditions, which this volume embraces, Maui, the great culture-hero, the ancestral fisherman who in many a Polynesian myth hooks up the islands from the ocean, is by no means prominent. We have details of the descendants of polygamous gods which rival the genealogical chapters of Scripture in their dryness; but these are followed by many variants of the wide-spread myth of the separation of earth and sky, the substance of which, old at its base but new in much of its superstructure, is as follows. Rangi (heaven) and Papa (earth) were lying together, and all between them were vines and creepers, tender plants, and red water. All was dark, and their children were born therein, but having seen a glimmer of light in the armpit of Rangi, they resolved to separate their parents. However much the myths differ in detail, they agree in assigning this task to Tane. Having sundered apart his father and mother, he propped up his father, but not liking to see the nakedness of the pair, he caught stars and threw them heavenward "to beautify Rangi, that he might be comely," and then went sunwards to bring trees and plants wherewith to clothe Papa. But the love of the parted ones was unabated; the tears of Papa are carried to Rangi as mist and dew, and the sighs of Rangi are borne on the west wind to Papa, "tickling his ears"; in another myth "he sighs for her in the winter, and this is the origin of ice." The dualism of Christian and other theologies peeps out in the myth that after Tane went to heaven, Tu and Roko destroyed the creatures which he had gathered for food, and then, following him, fought a battle on the borders of heaven, when Tu was slain and Roko cast down, like Satan and his wicked angels. And possibly we have some mixture of Eastern and Oceanian legend in the creation of man out of red clay, and of woman from a sloppy mixture which Tane makes in human shape, and then infuses life into it by processes which cannot well be detailed here. Neither are the traditions without a deluge, which Ta-whaki caused by stamping on the floor of the heaven until it cracked, when torrents of water flowed down and covered the earth. When he died, the green parrots took some of his blood and stained their feathers with it, hence the red colour of those birds to this day. Parallels and resemblances are not evidence of borrowings; the same explanations of like phenomena are often given by races at corresponding levels of culture. But, in the cases before us, we know how probable it is that alien elements have been assimilated, or that they have become confused with indigenous elements in the minds of chiefs who, as Mr. White remarks, "would have given the whole Maori history," both true and legendary, "but, unfortunately for us, these men were born too late; that is, their education began after the Whare-Kura and its rites had been neglected."

The lament or incantation which heads each chapter evidences not only the grace and fulness of the Maori language as a vehicle of poetic feeling, but also the truly astounding aptitude of the Maori mind for abstract thought. Remembering that the idea of a Supreme Being did not exist among the tribes, we, however, need very satisfactory proof that the subtle speculations embodied in the theory of Aeons, beginning with the age of thought and ending with the age of gods and men, and that such definitions as those which are given in this volume, *e.g.* of *Tua* as meaning "Behind all matter," and "Behind that which is most distant," are the genuine equivalents of Maori thought, and not the unconscious gloss of philosophic interpreters. How easy it is to make a serious mistake in the New Zealand tongue the following story, which is cited from Mr. Buller's work, shows:—

I knew a missionary who, in the early days, had a lesson in *Maori* in not the most pleasant way. It was expedient to give an occasional present to the chiefs in order to secure their good offices, for the lives of missionaries and their families hung upon their caprice. One day the said missionary was giving a small three-legged iron pot to an old chieftain, who, instead of being pleased with it, flew into a great rage, much to the surprise, and somewhat to the terror, of the donor. The cause of this was, he had said, "Mou tenei," whereas he ought to have said, "Mau tenei." Both phrases have, in English, the same meaning, "This is for you;" but, in Maori, there was an important distinction. By the latter form he would have been understood to say, "This is an iron pot for you to do with as you please;" but, by the unfortunate, but ignorant use of the other form, he was heard to say—what he never intended to say—"This is an iron pot for you *to be cooked in*." Hence the fury of the insulted chief.

* *I.e.* tabu, or taboo, as we commonly spell it, signifying the setting of something apart from human contact, investing it with an inviolate or sacred character. We have given the word another meaning, applying it to forbidden subjects, as "tabooing" a conversation.

ROYAL VICTORIA HALL.

(*To the Editor of* Knowledge.)

"ELECTRIC BELLS" formed the subject of a very interesting lecture given at this hall on Tuesday last by Prof. Sylvanus Thompson, who, instead of travelling hurriedly over a large space of ground, confined himself to explaining thoroughly and clearly this small department of electric science.

Ringing one of the many bells displayed on the stage, he inquired where the power was to be found which rang the bell? Imagine an intelligent savage investigating one of our common house-bells, with a crank to convert a perpendicular into a horizontal pull, tracing back the wires till he found the man at the other end pulling them. In like manner we must trace out the less obvious force at work in the ringing of an electric bell. It is no case of pulling, for the wires hang slack. We find one of the wires is connected with two bobbins of coiled wire, which, when the bell is ringing, constantly pull and let go a piece of iron connected with the clapper of the bell. The other wire is connected with this piece of iron, passes thence to an electric battery,

and on to the button which we press when we want to ring the bell. By pressing the button we make metallic communication between the free ends of the wires, so that a current can pass from the battery along them; and this current acts on something contained in the wire bobbins. That something is a core of soft iron, which, while the current passes along the wire which surrounds it, becomes strongly magnetic, and attracts the iron keeper connected with the clapper. But, by a very ingenious contrivance, at the moment the iron is attracted the metallic connection is broken and the current ceases. The iron core thereupon ceases to attract the keeper, and the current is re-established, a jerk being given to the clapper each time this happens.

A number of experiments were shown, illustrating both permanent and induced magnetism; and a variety of forms of electric bell were exhibited, from very sweet-toned church bells of a small size to a contrivance intended to wake up servants, which, when once the button is pushed, goes on ringing incessantly till the tormented servant goes to the bell and pulls a handle. Dr. Thompson then went on to inquire where the power comes from to produce these results, for we can never have results without a cause. There is no such thing as "perpetual motion." Wherever we have power, something must be spent to produce it. Here, it is clear, the power starts from the battery. What is used up there? In ordinary steam-engines we burn coal; in a gun the fuel is gunpowder; in a battery it is zinc. Zinc is combustible in air, though not freely so, and in a battery it is burnt in acid, the combustion going on while the current passes and the bell rings, but at no other time.

There are methods of obtaining a current without a battery; for instance, by turning a handle, and causing a coil of wire to rotate in presence of a permanent magnet. But the same principle holds with all. Something is used up to obtain the power; in this case the man who turns the handle plays the part of engine, and the food which he has eaten is consumed to do the work.

Dr. Thompson, in the course of his lecture, spoke of the large extent to which electric power is used in New England, as many as 200 shops in one town being supplied with it, from wires laid under the streets, as our gaspipes are laid. But for vested interests, he said, the same thing might be done in London, and power supplied to workshops with much economy both of space and money.

The lectures announced after Easter are—April 10, Dr. W. H. Halliburton, "Digestion, including Some Account of Plants that Eat Meat;" April 17, Professor George Henslow, "Movements of Plants;" April 24, Mr. W. P. Bloxam, "Soap-making."

C. A. Martineau.

1 Clifton Place, Sussex Square, W.C.

Gossip.

By Richard A. Proctor.

I deem it desirable to inform the readers of Knowledge that the delay in the issue of Part I. of my "Old and New Astronomy" has occurred through no fault of mine—nay, it has in reality been caused by a circumstance which should indicate the zeal with which I am striving to make this work (presenting the product of a quarter of a century's labour) as complete as possible.

* * *

Finding there was time, I asked Messrs. Spottiswoode to send me yet another revise, after the part had been already thrice revised by myself, and once by my friend Captain Noble. I thought no harm could come, and some slight good might come from my reading it yet another time. Unluckily Messrs. Longmans, hearing from the printers that a last revise had yet to be sent out, supposed there was some risk of the issue of Part II. being delayed, and very prudently (on that—mistaken—view of the case) ordered the postponement of the issue of Part I., lest there should be any breach of continuity in the issue of parts.

* * *

The original delay (from January 1 to March 1) was not my doing, but as I was disabled for two months by a serious accident the delay occurred happily, for I think the issue must have been interrupted had Part I. appeared on January 1.

* * *

The New York papers of February 21 announce the death of a man named Romayne Dillon, who, though an utterly worthless ruffian considered in himself, afforded an interesting illustration of the inefficiency of American justice, where such trifling offences as murder and brutal assault are concerned—that murderous form of justice called lynch-law being the pleasing product of this inefficiency of normal justice. As I have for twelve years or so regarded this man as one who had had his pistol ready for myself—all unknowing of his cheerful purpose—I take some personal interest in his case.

* * *

During the last fortnight of December 1875, I was a guest (most of the time) at the Westminster Hotel, Union Square, New York, my customary stopping-place when in that city. I used often to pace up and down the ground-floor corridors, where, as I supposed, no guests had rooms, finding a sense of relief in this peripatetic habit from the monotony and solitude of hotel life in America for those of domestic tastes and proclivities. I noticed occasionally, but did not note, a kind of subdued growling (like old Bill Barley "in the beam") as I passed a particular door. I had no idea that this growling was in reality exceedingly portentous, and, as I have every reason to think, personally threatening.

* * *

On the evening of December 31, when I was in the reading room, I heard a report which, in my inexperience, I regarded as due to the fall of some metallic substance on the marble pavement of "my" corridor. But other readers, "being acquainted with the [sound] before," knew it meant shooting, and in a second or two every reader was in the corridor. Here we found an unfortunate fellow—John Dilliber, his name was—sitting against the wall supported by one of the waiters. He had been shot, but the man who had shot him had gone back to his room.

* * *

Dilliber made the following statement while he was waiting for the elevator: "I don't know why the man shot me. He came out in his shirt-sleeves while I was walking up and down the corridor, and asked what the devil I was prowling about there for. I told him I had as much right as any other guest to walk there; on which he whipped out a pistol and shot me."

* * *

So soon as Dilliber had been put into the elevator and carried up to his floor, we went round to his assailant's room. We found the man, Romayne Dillon, who had shot and mortally wounded an inoffensive stranger, in the hands of two men, waiting to be handed over to the police. He simply gave as his reason for shooting Dilliber, that "the fellow had been prowling round his door for days"—though, as a matter of fact, Dilliber had arrived only the day before.

XUM

On the trial claim was made that Dillon was a monomaniac, with the idea that enemies were constantly spying upon him. But it was pretty generally known that his monomania was simply a brutal and ferocious temper, which had already brought him into trouble for murderous assaults. He was no more mad than the judge who tried him.

* * *

However, he found his way, as other sane but murderous ruffians have done in America before and since, into a lunatic asylum instead of the appropriate halter, and, like others of his kind, having money to back pretended madness, he found his way out again. When I returned to America in 1879 he had already been more than two years at large, and he was then, though an escaped criminal lunatic, living comfortably and openly at the Fifth Avenue Hotel. He remained free during the rest of his life to kill anyone else who might annoy him; and he did not die a natural death (for a murderer), but in his bed, towards the end of February last.

* * *

Another ruffian of a characteristic kind died a week or two before the murderer Dillon. I was introduced a year ago to a young Englishman (a Marlborough boy he had been) who wore an eye-shade; and I presently learned that the evening before a "big old brute"—a man weighing some 15 stone—had forced a quarrel on the slight and rather small young Englishman (all these rowdies are cowards at heart), receiving a straight-hander between the eyes which "propped" him for the moment; but going in for the clutching, rough-and-tumble business, in which, thank God, our Englishmen are not often proficient—and only failing in his attempt to gouge an eye out because hauled off by two other English young men who were there. I saw the brute next day at the railway-station, and wondered that he had been let live so long in a country where, if brutal outrages are too frequent, irregular justice is also too frequently inflicted.

* * *

This ruffian, unlike Dillon, died a natural death, being shot in a quarrel. Unfortunately the man who shot him who was as cowardly a ruffian as himself (but chanced to be a trifle quicker "on the draw"), did not also get his quietus. It often happens that the community has to rejoice in the simultaneous extinction of two ruffians of this kind: and "oh! 'tis the sport to see" the murderer killed by his murderous mate. However, it did not happen so—more's the pity!—on this occasion.

* * *

The English reader must not imagine that life is unsafe in America for those who avoid the spots where ruffians most do congregate. Dillon's villainous temper might be met with in England or on the Continent as frequently as in America; and in his case it was only the escape of the criminal which was characteristic of American ways. Ruffians of the other type are only dangerous for those who either go out of their way to enter low drinking-shops and gambling dens, or for those who enter too readily into discussion with low-looking brutes in more respectable bars.

* * *

American newspapers give unfair ideas of American ways in this respect: for they not only exaggerate the brutal ruffianism of the rowdy, but they picture all their leading men in turn (Democrats in Republican and Republicans in Democrat papers) as swindlers, villains, or otherwise of evil life.

* * *

I had a curious illustration of American editorial ways recently. I had had occasion in the San Francisco *Examiner* to point out that a certain American "professor" is a fraud and a humbug. I gave documentary evidence of falsehood and malice anonymously perpetrated, apologised for by further falsehood (still anonymous) when corrected, and brought home to the real offender a year or two later by unmistakable evidence. This man had obtained high position in the chief national observatory of the United States, where he had "discovered" an impossible third satellite of Mars, and had been otherwise seriously discredited, but whence—unfortunately for science—he has passed to the chief command of a private observatory still more important on account of the telescopic power it will command.

* * *

I had occasion to point out that an honorary distinction conferred by the Royal Astronomical Society on this "scientistic adventurer" was really conferred on him only because he was "taken on trust" on the strength of official position unwisely given him, not for anything he had done, since he has, in fact, done practically nothing. I further went on to express my belief that had I chosen to communicate to members of the Astronomical Society's Council (at that time) the particulars of this "professor's" personal wrong-doing, his name would have been rejected with contempt.

* * *

So far so good. My letters were duly inserted, and, though the "professor" repeated his untruths (with ample opportunity of assuring himself, had he ever doubted it, that they *were* untruths) he was silent in the presence of my final evidence, and manifestly regretted that he had drawn me from the silence, contemptuous though it was, which I had long maintained.

* * *

But a monthly magazine of science—the *Sidereal Messenger*—chanced, unfortunately for him, to mention the thonging which it had been my unpleasant duty to inflict, and the "professor," believing, doubtless, that I should not be apt to see this magazine, for, though excellent, it is published in a rather out-of-the-way place (Northfield, Minnesota), repeated his untruths there. I saw them, however, and met them as before, repeating my remark about the fellow's election to honorary distinction in a society which is honourable as well as scientific. But I omitted to say, as I had in the *Examiner* (which I supposed the editor had seen), that it was by silence only that I had helped the "professor's" election. It should have been unnecessary, in any case, to explain that I had not helped by any positive assistance the election of a man whom I had already described as quite unworthy of the distinction conferred upon him.

* * *

The "professor" craftily took advantage of this omission, quoted the sentence (without the context) in an appeal to certain members of the Council of the Astronomical Society to contradict it, and obtained from two of them (personally unknown to me), Messrs. Knobel and Maunder, the manifestly correct statement that I had never assisted his election by any overt act—and could not have done so, not being on the council at the time. (I resigned in 1873, and have never of my own will allowed my name to be on the council lists since.) The editor of the *Sidereal Messenger*, having presumably forgotten what I implied in my letters to him, and said *totidem verbis* in my letters to the San Francisco *Examiner*, inserts Mr. Knobel's letter, and quotes Mr. Maunder's—as if these letters had any bearing whatever on my real statement.

* * *

In the meantime—it is this which seems characteristic of American journalistic notions—it seems never to occur to the editor either of the *Sidereal Messenger* or of the San Francisco *Examiner*, that a body of honourable gentlemen can be as certainly expected not to elect to any honorary distinction a man proved guilty of falsehood, chicanery, and malice, as (on the other hand) an average body of American politicians would be to elect any scoundrel who could in adequate degree make it worth their while. The editor of the *Sidereal Messenger* actually asks *me*—an Englishman—how I could feel certain that the Council of the Astronomical Society would reject a man with contempt who had been convicted of unworthy conduct!

* * *

A correspondent obligingly sends the following in regard to the question raised in Gossip for February :—

If it interests your readers, or your "polite" correspondent,—Logan Mitchell, in his "Mythology Revealed," published by Trübner, says, page 72:—"'The Egyptians,' says Plutarch, 'inserted nothing into their worship without a reason, nothing merely fabulous, nothing superstitious, as many suppose; but their institutions have either a reference to morals or to something useful in life, and many of them bear a beautiful resemblance of some appearance in nature.' Chæremon, the Egyptian philosopher, says:—'What is said of Osiris and Isis and all the sacred fables may be resolved into the stars, their occultations and risings, into the course of the sun through the zodiac or the nocturnal and diurnal hemispheres.' Porphyry corroborates the above thus:—'The learned Egyptians admit of no other gods except what are called the planets, the gods which give completion to the zodiac, and such as rise together with these, and likewise the sections of the zodiac into decans."

"According to Eratosthenes, the celestial Virgin was supposed to be Isis, that is, the symbol of the returning year. It was in honour of this goddess that the Egyptians celebrated the famous festival of light, which was imitated by the Christians in their feast of Candlemas. From the Egyptians the Romans took their solar festivals, in honour of the birth of the god of light (the sun), celebrated on December 25, at which time, says Servius, the sun may, properly speaking, be said to be new, or have a new birth. Hence the Christmas of the Christians, which had also been, previously, a Druidical festival in honour of the solar god's birth; hence the evergreen emblems—the holly, the mistletoe, &c., all sacred among the Druids thousands of years before Christ."

Ib., page 86. "The 'star in the east' (a sign containing more than a hundred stars), mentioned in Matthew, was no other than this zodiacal sign of the celestial virgin, which arose on the eastern horizon precisely at the time at which we fix the birth of Jesus Christ—viz., December 25, when the sun had risen one degree above the solstitial point,* which answers to a moment to the births of the Egyptian Osiris, the Grecian Bacchus, and the Mithra of the Persians. These mystic births are manifestly identical, being metaphorical of the sun's annual birth at the winter solstice, after which he gradually becomes, not only figuratively, but positively the Saviour of the world. The resemblance, or rather the sameness, of every circumstance relating to Mithras, the Mediator of the Persians, and those connected with the Saviour, or Mediator of the Christians, is so apparent that no rational man can doubt, or hesitate a moment, in pronouncing the latter to be a counterpart of the former.

"Zoroaster taught the Magi that this celestial birth would be announced by the rising of this star, or constellation of the Virgo, in the middle of which would appear the figure of a young woman, suckling an infant child, called Jesus by some nations, and Christ or Christos in Greek. This was the goddess of the year nursing the god of day."

* * *

Mr. Francis Ram sends me a long letter about whist, maintaining his position that scientific whist is no more effective than "bumble-puppy." I have no space for letters about scientific whist from a writer who professes to know nothing about it. If he will not believe my assurances (as one who *knows*) that scientific whist is an entirely different game from what he knows as whist, I cannot help it. All I can do is to repeat my statement. I will not strive to show why scientific whist, played by two partners who understand its principles, is invariably successful (in every spell of play long enough to eliminate the effects of chance). The case is so, to my *knowledge*; and, were it otherwise, scientific whist is a game worth playing, an admirable recreation for the tired worker. The game Mr. Ram supposes to be whist is not worth sitting down to. "Double dummy" is a finer game in the scientific sense than the best whist played by four. But it is too difficult to be called recreation.

* * *

A correspondent asks me about my treatment of the function $\sin^{-1}x$ in my little book, "Easy Lessons in the Differential Calculus," under the impression that $\sin^{-1}x$ is the same as $(\sin x)^{-1}$. This is not the case, though $\sin^{2}x$ is the same as $(\sin x)^{2}$. It has been agreed that $\sin^{-1}x$ shall represent "the angle whose sine is x."

* * *

The same correspondent calls my attention, however, to a real, though easily detected erratum. Near the top of page 34 in that little book $\sin^{-1}x$ appears instead of sin x.

* * *

The chess editor of the *Australasian* calls attention to the fact that in an article on the "Wonders of Blindfold Chess," I not only make mistakes about Paul Morphy's career, but have an illustration representing a chess player blindfolded and feeling for the men. The *Australasian* is good enough to express its belief that I am not responsible for this particular absurdity (I should hope not), but in a tone implying that I *might* be guilty of absurdities as great and greater. Considering that I have played blindfold chess, and have written about my experience in that sort of play, it is rather too patent a bit of spite to write thus of me. This was the sort of thing Mr. Gossip used to do in chess literature; and one might almost imagine he had lighted on the Melbourne chess-world—though, for Melbourne's sake, it is to be hoped not. The chess editor of the *Australasian* when I was in Melbourne was Mr. Wisker, formerly the chess champion of England. I do not know who has held the reins since his death. I fear there has been a noteworthy falling-off. As for the mistakes about Paul Morphy, most probably they are imagined. But in any case they are not mine. They are made, in a sketch of Morphy's chess tour in Europe, by a gentleman who accompanied him most of the time.

* * *

A correspondent asks "if any review has appeared in Knowledge of Mr. Lockyer's meteoric theory?" When we hear of any meteoric theory advanced by Mr. Lockyer we will gladly review it. At present we know only of a meteoric theory suggested, advanced, and maintained by others during the last quarter of a century which some one in the *Times* has endeavoured (in a five-column article) to hand over to Mr. Lockyer! The wicked say the author of the article is Mr. Lockyer himself; but that seems too wild a fancy to be possible. In the Royal Society, however, the method of advancing the meteoric theory recently adopted has been described, publicly, by an eminent physicist as an insult offered to the society by Mr. Lockyer; and Mr. Lockyer himself has been sat upon, after the manner of speaking, almost as severely as if he had really written that Lockyer-adulating article! "'Tis true 'tis pity: pity 'tis 'tis true."

* * *

* This is of course quite wrong. On December 25 now the sun has not risen more than 3 or 4 min. above his solstitial elevation. But December 25 may have been the very day of the solstice in old times.

XUM

Reviews.

Biographies of Words and the Home of the Aryas. By F. Max Müller. (Longmans.)—This book is, in the main, a reprint of articles which have appeared in *Good Words*, its enlargement into a fairly-sized volume being effected by long lists of common Aryan terms, and by a series of appendices on the original home of jade, of the Soma, &c. Despite the universally adverse judgment of competent critics upon the cardinal argument of the professor's unwieldy book on the "Science of Thought," viz., that thought is impossible without language, we find that argument restated in the very beginning of the introductory chapter to the present work. "Ephraim is joined to his idols; let him alone." Yet we must again tell the distinguished author that he is confounding symbol with substance, and process with product, that language is not thought, any more than writing is thought, but only the vehicle whereby it is made current. Moreover, cannot the deaf and dumb think? How delightful an expositor Professor Max Müller can be, when we get him away from his obstinate heresies, the following extract shows:—

> There are historical documents which cannot be falsified, though they may be often difficult to interpret—I mean the words of a language. If we wished to know, for instance, who has taught us the game of chess, the name of chess would tell us better than anything else that it came to the West from Persia. In spite of all that has been written to the contrary, chess was originally the game of kings, the game of shahs. This word *shah* became in Old French *eschac*, Italian *scacco*, German *Schach*; while the Old French *eschecs* was further corrupted into *chess*. The more original form *chec* has likewise been preserved, though we little think of it when we draw a cheque, or when we suffer a check, or when we speak of the Chancellor of the Exchequer. The great object of the chess-player is to protect the king; and when the king is in danger the opponent is obliged to say "check"—*i.e. shah*, the king! In the book of the Duchesse, 658, as quoted by Professor Skeat, we read: "Therewith Fortune seyde, '*chek here*!' and '*mate*' in the myd point of the *chekkere*"—*i.e.* Thereupon Fortune said, "*check* here!" and "mate" in the middle of the chessboard. After this the various meanings of check, cheque, or exchequer become easily intelligible, though it is quite true that, if similar changes of meaning, which in our case we can watch by the light of history, had taken place in the dimness of prehistoric ages, it would be difficult to convince the sceptic that *exchequer* or *scaccarium*, the name of the chessboard, was afterwards used for the checkered cloth on which accounts were calculated by means of counters, and that a checkered career was a life with many cross lines, which might end with *check mate*; literally, "the king is dead."

In the chapters on the home and earliest civilisation of the Aryans Professor Max Müller restates and groups the arguments in support of an Asiatic origin, but this is a subject on which, as Penka and others have shown, both the biologist and the anthropologist will have to be taken into counsel, and upon which, while suspending judgment, we watch the balance incline towards the Northern Europe theory.

Social History of the Races of Mankind. Second Division: Oceano-Melanesians. By A. Featherman. (Trübner & Co.)—Mr. Featherman continues his laborious, and, we fear, as yet slenderly appreciated, task of compiling from all available sources materials for generalisation concerning the social stages which mark the relative place of the races of man. His present volume deals with some prominent groups, notably those found in Madagascar and New Zealand, concerning whom the information appears accurate and up to date. Many interesting questions suggest themselves as we turn over these pages; for example, what is the past relation of people so widely sundered as Malagasy and Maori to the great Mongoloid stock on the mainland? Perhaps when Mr. Featherman has finished his gigantic task, he may indicate his general conclusions from the data which his toil has gathered. We think that he has again erred in printing prefatory matter which is not only discursive in character, but which has no relation to the body of his work, and we say this not merely because, so far as we are able to understand it, we disagree with his theory of organic evolution, but because a preface should have connection with that which is to follow it.

Sunlight. By the Author of "The Interior of the Earth." (London: Trübner & Co. 1887.)—When an author states in his preface that "we do not know that the sun is hot," and that by "light we get our expansion of gases as evaporation; on this follows the condensation and fall of the liquid gases as they meet the colder air; then follows the rarefaction of our air by cold pressure, getting rid of all earthy particles till the upper air meets the impalpable cold ether of space without friction"; when, moreover, this author quotes "Nature and the Bible," by a Mr. Jas. Davis, as any authority whatever on a scientific subject; explains (?) gravitation by the action of light, and regards meteorites as "earthy atoms separated from the air by cold pressure and by vegetation," we feel that seriously to criticise such hopeless rubbish would be an insult to our readers' understanding. The writer of this stuff falls foul of Mr. Kinns on p. 144; but as we cannot discover that he has yet quarrelled with the author of "The Mystery of Gravity" (of which a notice appeared on p. 236 of our last volume), we would suggest that he should seek an introduction to that gentleman. Whether he would get much light from Mr. Fraser's heat, or whether, as seems more probable, his light would develop considerable heat in his rival physicist, remains to be seen.

An Introductory Text-book of Zoology. By H. Alleyne Nicholson, M.D., &c. 6th Edition. (Edinburgh and London: William Blackwood & Sons. 1887.)—It may seem almost an act of supererogation to criticise a work which has run into its sixth edition, but for the fact that in the volume now before us Dr. Nicholson has made certain changes in his arrangement of particular groups, and has added notably to the illustrations which appeared in his book in its original form. Whether for the use of schools or for self-instruction, it would not be easy to find an elementary work on systematic zoology to surpass the one before us.

Recollections of Forty Years. By Ferdinand de Lesseps. Translated by C. B. Pitman. (London: Chapman and Hall. 1887.)—From its title-page to the colophon this work of M. de Lesseps is essentially of the French, Frenchy. He is perpetually paraphrasing the familiar line in the poem of Jack Horner, in which that hero "said what a good boy am I;" and poses on almost every page as one of the most daring, indefatigable, and withal, successful men of genius ever produced by the most daring, indefatigable, and successful nation that the world has yet known. But despite this exhibition of almost more than womanly conceit, he has produced a work no small portion of which must possess an abiding interest for all Englishmen, telling us as it does the history of the Suez Canal, and of its ultimate triumph over the blind and ignorant opposition of Lord Palmerston and the British Government. Of Lord Palmerston himself M. de Lesseps says, in describing an interview which they had on the subject of the Canal, "I could not help asking myself now and again whether I was in the presence of a maniac or a statesman;" words which acquire peculiar force in view of Lord Beaconsfield's subsequent acquisition of so large a share in the enterprise whose feasibility his predecessor simply refused even to discuss. But, having said this, we fail to follow the argument of the translator of M. de Lesseps in his preface, where he, in effect, contends that because

Lord Palmerston was utterly wrong in the matter of the Suez Canal, therefore M. de Lesseps must, *ex necessitate*, be right in his views as to the practicability of the Panama one and of the Channel Tunnel. We may well render all honour to the man through whose energy and perseverance so easy and admirable a highway to our own Indian Empire has been opened, without regarding him as infallible. One section of the work (which takes the form of a curiously loose and inconsequent series of chapters, partly autobiographical) has reference to the inception of the Panama Canal, and the glorification of all, and notably of the Frenchmen, engaged in it. The opening portion of volume i. is devoted to a kind of narrative, mainly documentary, of its author's early diplomatic experiences. His account of the scandalous and treacherous assault of the French army upon Rome in 1849 is peculiarly instructive, as showing that *la grande nation* can be guilty of conduct at least as mean, contemptible, and cowardly as that of any of the countries at whose expense he is always so eager to exalt her. The miscellaneous chapters of M. de Lesseps call but for little notice. Essays on Algeria and Tunis and on Abyssinia read like extracts from guide-books, while one on steam seems written to show that to Frenchmen alone are we indebted for its application to machinery and locomotion—a contention which can only excite ridicule and derision in all familiar with the true history of the subject. A chapter on the origin and duties of consuls is the merest "padding." The speech of M. de Lesseps himself and that of M. Renan on the occasion of the admission of the former to the French Academy in 1885 (in which "the butter-boat" was passed in a manner worthy of the concluding meeting of the British Association itself) finish a work which, *malgré* the childish vanity it betrays, forms a real addition to the history of the present century. We began by speaking of its essentially French character. Perhaps no better illustration of this could be found than that of its author's delicate excuse for the lady he calls "Madame Potiphar" (the heroine of Genesis xxxix.) on p. 222.

The Dictionary of National Biography. Vol. XIII. Craik-Damer. (Smith, Elder, & Co.)—The publication of this magnificent work is now being accelerated, and we may hope to witness its completion within a few years. We are not surprised to find that its spirited publishers have been compelled to make a moderate increase in the price; even with this, we fear that their enterprise will have to wait for substantial reward. They are undertaking a task worthy of State subvention, only that subventions are as miasmas upon individual energy.

Management of Accumulators. By Sir David Salomons, Bart., M.A., &c. (London: Whittaker & Co. 1888.)—Most people have heard of the perfect electric light installation at Broomhill, Sir David Salomons's seat, near Tunbridge Wells, and will hence recognise his authority to speak *ex cathedrâ* upon the subject. His practical experience has enabled him to produce a work of real value to those who may be about to introduce electric lighting into their own establishments. His perspicuity of treatment, plainness of language, and abundance of illustration will commend themselves to all seeking aid in their incipient efforts in home lighting by electricity.

A Critique of Kant. By Kuno Fischer. Translated from the German by W. S. Hough. (London: Swan Sonnenschein, Lowrey, & Co. 1888.)—For more than 2,500 years the metaphysical mind, disdaining that verification which lies at the very foundation of scientific method, has beaten the air in vain. Foremost among the self-deceived may be classed the immortal Kant, whose speculations have exercised so preponderating an influence on subsequent German thought. To all who may be interested in watching the process by which a mighty intellect could juggle with words in an attempt to arrive at "the thing as it is" (*Ding an sich*) we would commend the perusal of Mr. Hough's admirable rendering of Fischer's familiar work. The intelligent reader, approaching the subject from the scientific standpoint, will not be long in detecting how and where Kant's exposition of the connection between the noumena he postulates, and the perception of the phenomena he seeks to explain by them, is fallacious. No more instructive example of the emptiness of metaphysical speculation could well be found.

Insect Ways on Summer Days. By Jennett Humphreys. (London: Blackie & Son. 1888).—*Flower-Land.* By Robert Fisher, M.A. (London and Manchester: John Heywood. 1887).—We have classed these two books together as affording, each in its way, an excellent introduction to natural history for children. Miss Humphreys makes each insect tell its own story, and has devised a system of *memoria technica* of the generic and specific names of those so described in the shape of nonsense verses. As for Mr. Fisher's book, no child resident in the country, or who ever has the chance of spending twenty-four hours among heath, field, wood, or hedgerow, ought to be without it. It is a very long time since so admirable a little book for the very beginner in botany has appeared.

Dottings of a Dosser: Revelations of the Inner Life of Low London Lodging-houses, by Howard J. Goldsmid (T. Fisher Unwin, 26 Paternoster Square), is a little book calculated to be of the greatest possible value in attracting the eye of the public to the wrongs of an unfortunate class, which has hitherto been neglected by philanthropists. The dosser is a person too poor to afford a settled habitation, who, when he or she can scrape together the necessary fourpence, hires with it a bed for the night in some low lodging-house, and, when the money is not forthcoming, promenades the streets all night, or finds a resting-place on a seat on the embankment or on a doorstep, if the policeman on the beat will permit it. The dosser is below the class of picturesque poor for whom so much has been done of late; he would need a bath and a new suit before he could enter the "People's Palace" at the East End; he and his rags and his dirt have been hitherto beyond the pale of fashionable benevolence. Mr. Goldsmid writes boldly of the wretched squalor into which these poor unfortunates are thrust by the inefficiency of the law respecting common lodging-houses. The quotation on his title-page is from the Common Lodging-houses Act of 1851: "Whereas it would tend greatly to the comfort and welfare of many of Her Majesty's poorer subjects if provision were made for the WELL ORDERING OF COMMON LODGING-HOUSES," but his whole experience shows that no such provision has been made. With an admirable courage Mr. Goldsmid has obtained personal evidence of the state of affairs by himself becoming an inmate of a large number of these houses, which may fairly be taken as samples of the rest. He has found them in a rickety and broken-down condition, with improper sanitary arrangements; the kitchens, in which the lodgers sit and cook their scanty meals, filthy in the extreme; the bedrooms still more loathsome, invariably overcrowded, and the beds full of vermin. In some rooms, which can hardly accommodate three persons, the law permits eight to be huddled. Yet these places are periodically inspected, and "we must suppose, therefore, that it is permissible for the proprietors of the 'doss-house' to half poison their lodgers, and compel them to inhale an atmosphere which would be regarded as intolerable at any well-regulated sewage wharf." In almost all these houses men and women are herded together without any regard to

morality or even decency, and numbers of poor children grow up in the midst of surroundings which will surely bring them to join the crowded ranks of the criminal classes. The School Board does not reach these children, and a lodger in one of the houses told Mr. Goldsmid that there was not a School Board officer in the metropolis who would "dare to show 'is ugly mug 'ere." The police inspectors whose duty it is to regulate these houses, visit them only during the daytime, when the lodgers have departed, order has been to a certain extent restored, and the fearful odours of the night have gone off; hence they gain no adequate ideas of the real state of affairs, and legislate for what they do not understand. Mr. Goldsmid holds that the administration of the Lodging-houses' Act should be taken out of the hands of the Commissioners of Police, and that a company should be formed to supply clean and decent accommodation for poor lodgers. He suggests that blocks of the artisans' model dwellings, now being erected in all parts of London, should be arranged so that the rent could be paid nightly instead of weekly, that bathing conveniences should be provided, and that plain, wholesome food should be sold ready cooked on the premises at similar prices to those charged in coffee-houses. He believes that such a company should pay a dividend of 10 to 12 per cent., even if giving the best value for the money. The present common lodging-house keepers, he calculates, make about 125 per cent. profit, wrung from their poorer brethren, whom they keep in a horrible condition of filth, squalor, and degradation. We consider Mr. Goldsmid's suggestion a wise one, and recommend it to practical philanthropists. "Dottings of a Dosser" should be very widely circulated.

THE FACE OF THE SKY FOR APRIL.

By F.R.A.S.

THE sun may be watched for the infrequent and insignificant spots which appear on his surface. The zodiacal light may still be seen in the west after sunset at the beginning of the month. The aspect of the night sky is shown on map iv. of "The Stars in their Seasons." Minima of Algol ("The Stars in their Seasons," map xii.) will occur 15 minutes after midnight on the 15th, and at 9h. 4m. P.M. on the 18th, all other minima happening in daylight during April. Mercury is a morning star throughout the month, but rises such a little while before the sun that he is but indifferently placed for the observer—a remark which, *mutatis mutandis*, applies equally to Venus. Mars will be in opposition to the sun on the 6th, and but for the fact that he has South Declination, would be well placed for observation. As at this time his disc subtends an angle of some 18″, a considerable amount of areographical detail may be made out with comparatively moderate optical means. He is situated to the north-east of Spica Virginis ("The Stars in their Seasons," map v.) Jupiter does not south until the early morning, but towards the end of April may be seen before midnight, though he is too close to the horizon to be at all fairly observable. Moreover, his South Declination is so considerable that even when on the meridian his altitude is too small to admit of the employment of a high power in viewing him. By the end of April his angular equatorial diameter will amount to 41·5″. He is travelling from the south-west corner of Ophiuchus towards β Scorpii ("The Stars in their Seasons," map vii.). As scarcely any certainly observable phenomena of his satellites will occur before midnight, we need not occupy space with them here. Saturn is travelling rapidly towards the west, and must be looked at as soon as ever it is dark enough. It will be noted that his rings have closed up to an extent such that his north pole is now visible. He is moving towards η Cancri and the Præsepe ("The Stars in their Seasons," map iii.). Uranus will come into opposition to the sun on the 4th, so that he is now in a fairly good position for the observer. He will be found about three diameters of the moon to the west of θ Virginis ("The Stars in their Seasons," map v.), and may be at once distinguished from the surrounding stars by his bluish unmistakable planetary disc, when viewed with adequate power. Neptune has disappeared for the season. The moon enters her last quarter at 41·3m. past noon on the 3rd, and is new at 9h. 7·7m. o'clock in the morning on the 11th. She enters her first quarter 7·8m. before noon on the 19th, and is full at 6h. 22·1m. A.M. on the 26th. High tides may be expected about the last-named date. Three occultations only of fixed stars by the moon will occur at convenient hours during the present month. The first will happen on April 16, when χ^2 Orionis, a star of the 6th magnitude, will disappear at the moon's dark limb at 9h. 27m. P.M., at an angle from her vertex of 139°. It will reappear at her bright limb at 10h. 26m. P.M., at an angle of 300° from her vertex. Then on the 19th, θ Cancri, of the 6th magnitude, will disappear at the dark limb of the moon at 7h. 34m. P.M., at an angle from her vertex of 70°; reappearing at her bright limb at 8h. 45m. P.M., at a vertical angle of 308°. Lastly, on the 22nd, B.A.C. 3837 (also a 6th magnitude star) will disappear at the dark limb at 6h. 9m. P.M., at an angle of 90° from the moon's vertex. The star will reappear at the bright limb of the moon at 7h. 32m. P.M., at an angle from her vertex of 173°. At noon to-day the moon is in Ophiuchus, through which she is travelling until 8h. A.M. on the 2nd, at which hour she passes into Sagittarius. She leaves Sagittarius for Capricornus ("The Seasons Pictured," plate xxi.) at 3h. P.M. on the 4th, and Capricornus in turn for Aquarius at 4h. P.M. on the 6th. Her journey across Aquarius is completed by 9h. P.M. on the 8th, when she enters Pisces ("The Seasons Pictured," plate xxii.). It is 11h. P.M. on the 11th when, in her passage over this great straggling constellation she reaches the northerly prolongation of Cetus, and an hour or two afterwards she has crossed it and emerged in Aries ("The Seasons Pictured," plate xxiii.). By 7h. 30m. P.M. on the 13th she has traversed the constellation last named and passed into Taurus. As she travels through Taurus she arrives at 7h. P.M. on the 16th on the western edge of the northernmost portion of Orion. Exactly twelve hours later (*i.e.* at 7h. A.M. on the 17th), she crosses its eastern boundary and emerges in Gemini. Here she remains until 4h. A.M. on the 19th, when she crosses into Cancer ("The Seasons Pictured," plate xxiv.). She is in Cancer until 6h. P.M. on the 20th, when she enters Leo. Her passage through Leo terminates at 7h. A.M. on the 23rd, at which hour she quits it for Virgo ("The Seasons Pictured," plate xxv.). At 3h. 30m. A.M. on the 26th, her journey over the constellation last named finishes, and she passes into Libra ("The Seasons Pictured," plate xxvi.). As she travels through Libra, she arrives at 8h. P.M. on the 27th at the western boundary of the narrow northern spike of Scorpio, and when she has crossed this by 4 o'clock the next morning, it is to come out in Ophiuchus. She remains in Ophiuchus until 3h. P.M. on the 29th, when, for the second time this month, she enters Sagittarius. There we leave her.

Our Whist Column.

By "Five of Clubs."

MATHEWS ON WHIST.

The Tenace.

(*Continued from* page 96.)

THOUGH "tenace," or the advantage of position,* cannot be reduced to a certainty, as at piquet, and it is often necessary to relinquish it for more certain advantages; still, no man can be a whist-player who does not fully understand it. The principle is simple, but the combinations are various.

If A has ace, queen, and a small card of a suit, of which B has king, knave, and another; if A leads the small card, he retains tenace, and wins two tricks; whereas, if he plays the ace, he gives it up and makes but one. But if B is to lead, he has no tenace; and lead which card he will, he

* The word "tenace" has no connection, as many imagine, with the cards ten and ace in a suit, though it very often happens that the major tenace is actually constituted of these two cards. The word is a substantival form of the French adjective "tenace," *tenacious, holding*, and implies the "hold" which the tenace gives over the suit. "Major tenace," or the first and third cards, gives the stronger hold; but minor tenace gives a good hold too, in each case, though only if the holder of either tenace is led up to—when, with major tenace, two tricks are made, the second best card being held safe, while with minor tenace, one trick is made, the third best card being held safe, wherever it may lie. The second best guarded, if led up to, is as good as the minor tenace.

must make one trick, and can make no more. The study of this easy instance, well considered, will enable the player, with some practice, to adapt it to more apparently intricate situations. The following cases, which happen frequently, will further explain the principles of the tenace:—Y is left with four cards and the lead, viz., the second and fourth trump, and the ace and a small card of a suit not played. Nine trumps are out, A, Y's left-hand adversary, has the first and third trump, king and a small one of the suit of which Y leads the ace: what card should A play? If A keeps his king he cannot possibly win more than two tricks: he should, therefore, play the king; for he thus brings it to an equal chance whether he wins three tricks or two. By placing the cards you will perceive, that if A's partner has a better card that Y's, Y cannot make either of his trumps, which, had B retained the king, he must have done.

Y has three cards of a suit not played (the last remaining) viz, king, queen, and ten; A holds ace, knave, and another; Y leads the king; if A wins it he gives up the tenace, and gets but one trick; whereas, if he does not, he makes his ace and knave by preserving it.

A has ace, knave, and ten of a suit which his partner leads. If he puts on the ace, and his partner has no honour in the suit, he gives up the tenace, and can only win one. He should, therefore, play the ten (particularly if the lead is forced); for by this he probably wins two tricks.

It often happens that with only three cards remaining in his hand, the leader has the worst trump, and ace, queen, or some tenace of another suit. In this case he should lead the trump, to put the lead into an adversary's hand. By these means he preserves the tenace. This, though self-evident on proper consideration, is what good players never think of. Tenace is easily kept against your right-hand, but impossible, without great superiority of skill, against your left-hand adversary.

You should not only endeavour to preserve the tenace, an advantage of position to yourself when it is evident that the winning cards lie between you and an adversary, but you should do all in your power to give it to your partner, when you perceive that the strength in any suit lies between him and your left-hand adversary. In this case bear in mind that when the left-hand adversary or you lead, the tenace is against the adversary, whereas, if your partner has to lead, the tenace is in favour of your adversary.

False Cards.

There is nothing more necessary to be explained to the beginner than what is usually denominated "under-play," as it is a constant engine in the hands of the experienced to use successfully against the inexperienced player.

As an illustration of under-play—You return the lowest of your left-hand adversary's lead, though you have the highest in your hand, with a view to your partner's making the third best, if he has it, and still retaining the commanding card in your hand. For instance, if A, fourth player, has ace, king, and a small one of his left-hand adversary's lead, to under-play, he wins the trick with the ace and returns the small one, which will generally succeed if the leader has not the second and third in his own hand. You will see by this [putting yourself in the position of the player on whom this under-play is tried] that if you lead from a king and others, and your right-hand adversary, after winning with a ten or knave, returns it, you have no chance to make your king but by putting it on [assuming that your right-hand adversary is under-playing; but even if he is not, his return of your lead would show your king probably worthless, as it would indicate shortness in the suit, so that you can lose little by playing the king].

The following is another situation for under-play:—A remains with the first, third, and fourth cards of a suit, of which he has reason to suppose his left-hand adversary has the second guarded; if he leads the fourth, it is often passed, and A makes every trick in the suit. [It is hardly necessary to say that the lead is not the first in the suit.]

[This play is usually right if you are strong in trumps; but if you are weak, it is generally the best play to make your certain tricks as fast as you can, for the adversaries are probably strong in trumps, and therefore weak in some other suit, which probably is your strong one. Even in this case, however, if you are well protected in the other plain suits, the under-play indicated by Mathews is good; for, if successful, it gives you good forcing-power in the suit, which will probably enable you to make the balance of its strength. If you gain but one trick in this way by a long card in the suit, it must be remembered that one trick made by "play" in a hand signifies an important percentage of advantage. This is what weak players constantly overlook, not recognising the effect of good strategy unless three or four long cards in a suit are made against them. The sound player knows that one trick made by play in each hand would give him marked advantage, while one trick lost in each hand by bad play would signify crushing defeat in the long run. So great an advantage, indeed, cannot be expected from even the best play against the worst.]

The term "under-play" is now often, but incorrectly, used for all cases where a false card is played—that is, a card higher or lower than the one which would be played in accordance with normal whist language. The cases above considered are instances of under-play, except that in the detailed illustration of the first case the ace is played fourth hand from ace king instead of king as usual: this is "over-play," making the following "under-play" more effective, since the original leader of the suit would be apt to place the king anywhere but in your hand. What follows in regard to false cards relates to "over-play."

Though it is certainly more regular to win your adversary's as well as partner's lead with the lowest of a sequence, still I recommend occasional deviations from that maxim; as it is of the greatest advantage to give your partner every information in his suit or your own, so it is often well to deceive your adversaries in their suits. It will now and then deceive your partner also; but if done with judgment, it is, I think, oftener attended with good than bad effect.

There are also other situations where it is highly necessary to deceive the adversary. For instance, Z, last player, has a tierce-major and a small trump; a tierce-major with two others of a second suit; king, and a small one of a third; with queen or knave, and a small one of the fourth suit, of which his adversary leads the ace. It is so very material for Z to get the lead before he is forced, that he should without hesitation throw down the queen or knave as the most likely method to induce his adversary to change his lead. But this mode of play should be reserved for material occasions, and not by its frequency give cause for its being suspected.

[This may be regarded as the earliest suggestion of the signal for trumps. If the adversary should not change suit, Z's partner on the fall of the small card would perceive that Z had played the high card to avoid being forced, and if he himself took the second trick would immediately lead trumps (his best, if short in trumps), precisely as in response to the trump signal of to-day. This way of indicating a wish for a trump lead belonged, however, to whist strategy, and was not, like the modern signal, a merely conventional arrangement, as little belonging to whist strategy as signalling by coughing, sneezing, or kicking under the table would be.]

(*To be concluded.*)

Our Chess Column.

By "Mephisto."

IN the following sprightly game some curious complications arise which are not often seen in actual play:—

White. Mr. E. Dale.	Black. Dr. J. W. Hunt.
Gambit Declined.	
1. P to K4	1. P to K4
2. Kt to QB3	2. Kt to QB3
3. P to B4	3. B to B4

Experience has pronounced against this move in consequence of unsatisfactory results following on its adoption in many important match and tournament games. If Black does not intend to accept the Hampe Gambit, his best plan would be to play 2. KKt to B3 instead of 2QKt to B3.

4. Kt to KB3	4. P to Q3
5. B to B4	5. P to QR3

To prevent the exchange of the active Bishop for the QKt by Kt to QR4, which sometimes precedes this move. The second player can hardly afford the time for such a passive move in this opening

6. Q to K2

A lost move.

6. B to KKt5

7 R to Bsq

A speculative move. If Black replies with 7. Kt to Q5, then might follow 8. B × P (ch), K × B. 9. Kt to Kt5 (ch) (*a*). K to Ksq (best). 10. Q × B, Kt to KB3 (*a*). White might, in this variation, give up the piece by 9. Kt × KP (ch); in both cases White will obtain an attacking position.

	7. P × P
8. B to Kt3	8. Kt to Q5
9. Q to B4	9. Kt × Kt (ch)
10. R × Kt	

XUM

There was no necessity for playing this move. P × Kt was quite safe; for attacking purposes the move was not effective.

	10. Q to R5 (ch)
11. P to Kt3	11. Q × RP.

It seems that both players pay no regard to each other's attack. White certainly seems to have a pull by being now able to go at it first.

12. Q × P (ch)	12. K to Qsq
13. Q to B8 (ch)	13. K to Q2
14. Q × P (ch)	14. K to B3

necessary, as otherwise Q × B with a check.

15. Q × B	15. Kt to R3
16. Q to R4	

Black's last move was simple, but effective. If White had played Q × P, then R to KBsq would compel White to exchange his Queen for two Rooks, when Black would certainly have the better prospects. White cannot gain anything by checking the Black King.

	16. Q to Kt8 (ch)
17. R to Bsq	17. B to B7 (ch)
18. K to K2	18. P to B6 (ch)

A very curious position indeed. Escape is impossible.

19. K × P	19. Q × R
20. Q × Kt	

Black threatened mate with the Rook, and also by a discovered check with the B.

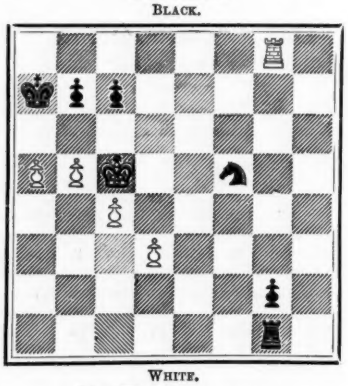
	20. B × P (ch)

and wins; for if 21. K × B, R to Ktsq (ch), and mate follows.

DRAWING GAMES.

In an end game a good player shows to advantage. Both exactness and ingenuity are necessary to carry a difficult ending to a successful issue. Some players excel in one kind of end play, such as those involving brilliant sacrifices; others, again, are very good at pawn play. Probably the most useful knowledge is possessed by the player who has a knack of drawing games which seem to be lost for him. It is beyond doubt an acquirement peculiar to some players more than others, and an experienced player will always take into his calculation the style of end game play of his opponent, and suit his play accordingly; for to emerge with anything like an even ending against some players may mean to secure victory, whereas with other players no advantage short of a piece will secure an absolute win. The following two endings are ingenious examples how lost games are saved by drawing:—

Dr. Smith.
Black.



White.
Mr. W. Donisthorpe.

Black played

P to Kt3 (ch)

for if now K to Kt4, then R to Kt8 (ch) wins; or if P × P, P × P (ch), K to Q5 or B6, then Kt to K2 (ch) wins. White replied with

K to B6

braving the consequences; thus if Kt to K2 (ch), K × P, Kt × R, White mates in three moves; whereupon Black played

Kt to Q3

Had White now played K × P, Black would have replied with Kt × P (ch), and the white P could not take the Kt, as Black would otherwise obtain a check with his Rook on B8 and Queen his P. White replied by

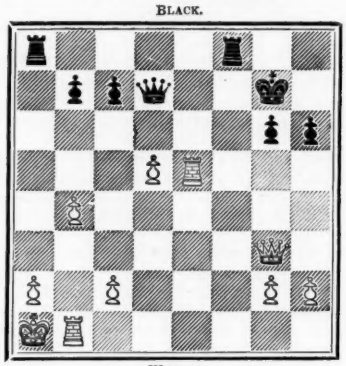
K to Q5	Kt to B5
K to B6	

and the game was therefore abandoned as a draw. Black, however, had some chance of winning by playing Kt to Q5 (ch) instead of Q3; for if then K × P, Kt × P (ch), as beforesaid, K to B6, Kt to Q5 (ch), K to Q5, Kt to B5, P × P (ch), K × P, P to B5 (ch), K to B2, R to Kt5 or P to B6, then Kt to Q6 (ch), followed by R to Q8, and the Pawn will win. Or if after Kt to Q5 (ch) the White King does not take the Pawn, but retires to Q5, Black might play

	Kt to Q5 (ch)
K to Q5	P × P
K × Kt	P to R5
K to B5	P to R6
P to Kt6 (ch)	K to Kt2

and Black will win.

Mr. W. Donisthorpe.
Black.



White.
Dr. Smith.

White played

R to Q6

whereupon Black drew by	R × P (ch)!
K × R	Q × P (ch)
Q to Kt3	R to Rsq (ch)
K to Kt2	Q to Q5 (ch)
K to Bsq	

If Q to B3, then Black plays R to R7 (ch), winning the Queen.

	Q to Kt8 (ch)
K to Kt2	

and Black drew by perpetual check, as White dare not play his K to Q2.

The following pretty game occurred in a match played in America between Messrs. Lipschütz and Delmar:—

Scotch Gambit.

White. Delmar.	Black. Lipschütz.	White. Delmar.	Black. Lipschütz.
1. P to K4	P to K4	9. P to KR3	Kt × P
2. Kt to KB3	Kt to QB3	10. R to Ksq	Q to B3
3. P to Q4	P × P	11. Q to K2	Castles
4. Kt × P	Kt to B3	12. Q × Kt	Q × P (ch)!
5. Kt × Kt	KtP × Kt	13. K to Rsq	B × P!
6. B to Q3	P to Q4	14. P × B	Q to B6 (ch)
7. P to K5	Kt to Kt5	15. K to R2	B to Q3
8. Castles	B to B4	16. Q × B	Q to B7 (ch)!
		Resigns.	

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